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SAR EVALUATION REPORT

Applicant Name:
Apple Inc.
One Apple Park Way
Cupertino, CA 95014 USA

Date of Testing:
02/28/2023 – 04/12/2023
Test Report Issue Date:
07/06/2023
Test Site/Location:
Element, Morgan Hill, CA, USA
Document Serial No.:
1C2302130007-12.BCG (Rev 1)

FCC ID: **BCGA2117**

APPLICANT: **APPLE, INC.**

DUT Type: Head Mounted Device
Application Type: Certification
FCC Rule Part(s): CFR §2.1093
Model: A2117

Equipment Class	Band & Mode	Tx Frequency	SAR	
			1g Head (W/kg)	10g Extremity (W/kg)
DTS	2.4 GHz WLAN	2412 - 2472 MHz	<0.1	2.86
NII	U-NII-1	5180 - 5240 MHz	<0.1	2.94
NII	U-NII-2A	5260 - 5320 MHz	<0.1	2.87
NII	U-NII-2C	5500 - 5720 MHz	<0.1	2.93
NII	U-NII-3	5745 - 5825 MHz	0.10	2.96
DSS/DTS	Bluetooth	2402 - 2480 MHz	<0.1	2.18
NII	NB UNII-1	5157 - 5245 MHz	<0.1	<0.1
NII	NB UNII-3	5731 - 5844 MHz	<0.1	<0.1
Simultaneous SAR per KDB 690783 D01v01r03:			0.15	3.85

Note: This revised Test Report supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in Section 1.7 of this report; for North American frequency bands only.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Test results reported herein relate only to the item(s) tested.

RJ Ortanez
Executive Vice President

The SAR Tick is an initiative of the Mobile & Wireless Forum (MWF). While a product may be considered eligible, use of the SAR Tick logo requires an agreement with the MWF. Further details can be obtained by emailing: sartick@mwfai.info.

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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
2.4 GHz WLAN	Voice/Data	2412 - 2472 MHz
U-NII-1	Voice/Data	5180 - 5240 MHz
U-NII-2A	Voice/Data	5260 - 5320 MHz
U-NII-2C	Voice/Data	5500 - 5720 MHz
U-NII-3	Voice/Data	5745 - 5825 MHz
Bluetooth	Data	2402 - 2480 MHz
NB UNII-1	Data	5157 - 5245 MHz
NB UNII-3	Data	5731 - 5844 MHz

1.2 Power Reduction for SAR

This device additionally utilizes a power reduction mechanism for Bluetooth operations. When Bluetooth is operating simultaneously with certain combinations of 5 GHz WLAN and NB UNII antennas, the output power is permanently reduced. SAR evaluations were additionally performed at the maximum allowed output power for these scenarios to evaluate simultaneous transmission compliance.

Additionally, this device uses an independent mechanism that limits WIFI powers to a time-averaged output power. For the purposes of this test report, all SAR measurements were performed with the algorithm disabled at the maximum time-averaged output power level. WIFI Time-averaged SAR Verification Appendix includes verification data for this time-averaged SAR mechanism.

1.3 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.

1.3.1 Maximum WLAN Time-Averaged Output Power

Note: Targets for 802.11ax RU operations can be found in 802.11ax RU Appendix.

Mode	IEEE 802.11 (Maximum in dBm) - Ant 1 Tolerance (+0/-3.00 dB)							
	Channel	SISO				MIMO		
		b	g	n	ax SU	g	n	ax SU
2.4 GHz WIFI 20 MHz Bandwidth	1	20.00	18.25	18.25	17.50	18.00	18.00	17.00
	2	21.50	19.25	19.25	19.25	19.00	19.00	18.50
	3	21.50	20.50	20.50	20.00	19.50	19.50	19.25
	4	21.50	21.50	21.50	21.50	21.50	21.50	21.50
	5	21.50	21.50	21.50	21.50	21.50	21.50	21.50
	6	21.50	21.50	21.50	21.50	21.50	21.50	21.50
	7	21.50	21.50	21.50	21.50	21.50	21.50	21.50
	8	21.50	21.50	21.50	21.25	21.50	21.50	21.25
	9	21.50	20.25	20.25	20.00	20.25	20.25	20.00
	10	21.50	19.50	19.50	19.25	17.50	17.50	19.25
	11	21.50	18.25	18.25	17.75	17.50	17.50	17.75
	12	20.00	15.75	15.75	15.50	15.75	15.75	15.50
	13	18.25	12.00	12.00	NS	12.00	12.00	NS

Note: In MIMO operations, each antenna transmits at maximum allowed powers as indicated above.

Mode	IEEE 802.11 (Maximum in dBm) - Ant 2 Tolerance (+0/-3.00 dB)							
	Channel	SISO				MIMO		
		b	g	n	ax SU	g	n	ax SU
2.4 GHz WIFI 20 MHz Bandwidth	1	20.00	18.25	18.25	17.50	18.00	18.00	17.00
	2	21.50	19.25	19.25	19.25	19.00	19.00	18.50
	3	21.50	20.50	20.50	20.00	19.50	19.50	19.25
	4	21.50	21.50	21.50	21.50	21.50	21.50	21.50
	5	21.50	21.50	21.50	21.50	21.50	21.50	21.50
	6	21.50	21.50	21.50	21.50	21.50	21.50	21.50
	7	21.50	21.50	21.50	21.50	21.50	21.50	21.50
	8	21.50	21.50	21.50	21.25	21.50	21.50	21.25
	9	21.50	20.25	20.25	20.00	20.25	20.25	20.00
	10	21.50	19.50	19.50	19.25	17.50	17.50	19.25
	11	21.50	18.25	18.25	17.75	17.50	17.50	17.75
	12	20.00	15.75	15.75	15.50	15.75	15.75	15.50
	13	18.25	12.00	12.00	NS	12.00	12.00	NS

Note: In MIMO operations, each antenna transmits at maximum allowed powers as indicated above.

Mode	Channel	IEEE 802.11 (Maximum in dBm) - Ant 1 Tolerance (+0/-3.00 dB)						
		SISO			MIMO CDD		MIMO SDM	
		a	n/ac	ax SU	a/n/ac	ax SU	n/ac	ax SU
5 GHz WIFI 20 MHz Bandwidth	36	18.25	18.25	17.75	16.50	16.50	16.50	16.50
	40	18.50	18.50	18.50	16.50	16.50	16.50	16.50
	44	18.50	18.50	18.50	16.50	16.50	16.50	16.50
	48	18.50	18.50	18.50	16.50	16.50	16.50	16.50
	52	18.50	18.50	18.50	16.50	16.50	16.50	16.50
	56	18.50	18.50	18.50	16.50	16.50	16.50	16.50
	60	18.50	18.50	18.50	16.50	16.50	16.50	16.50
	64	18.50	18.50	18.25	16.50	16.50	16.50	16.50
	100	18.75	18.75	18.75	16.50	16.50	16.50	16.50
	104	18.75	18.75	18.75	16.50	16.50	16.50	16.50
	108	18.75	18.75	18.75	16.50	16.50	16.50	16.50
	112	18.75	18.75	18.75	16.50	16.50	16.50	16.50
	116	18.75	18.75	18.75	16.50	16.50	16.50	16.50
	120	18.75	18.75	18.75	16.50	16.50	16.50	16.50
	124	18.75	18.75	18.75	16.50	16.50	16.50	16.50
	128	18.75	18.75	18.75	16.50	16.50	16.50	16.50
	132	18.75	18.75	18.75	16.50	16.50	16.50	16.50
	136	18.75	18.75	18.75	16.50	16.50	16.50	16.50
	140	16.00	16.00	16.00	16.00	16.00	16.00	16.00
	144	18.75	18.75	18.75	16.50	16.50	16.50	16.50
	149	19.25	19.25	19.25	19.25	19.25	19.25	19.25
	153	19.25	19.25	19.25	19.25	19.25	19.25	19.25
	157	19.25	19.25	19.25	19.25	19.25	19.25	19.25
	161	19.25	19.25	19.25	19.25	19.25	19.25	19.25
	165	19.25	19.25	19.25	19.25	19.25	19.25	19.25
5 GHz WIFI 40 MHz Bandwidth	38	[redacted]	15.25	14.25	15.00	13.25	15.00	13.25
	46		18.50	18.50	18.50	18.50	18.50	18.50
	54		18.50	18.50	18.50	18.50	18.50	18.50
	62		17.25	17.00	17.25	16.00	17.25	16.00
	102		16.50	16.25	16.00	14.75	16.00	14.75
	110		18.75	18.75	18.75	18.75	18.75	18.75
	118		18.75	18.75	18.75	18.75	18.75	18.75
	126		18.75	18.75	18.75	18.75	18.75	18.75
	134		18.50	18.25	18.50	18.25	18.50	18.25
	142		18.75	18.75	18.75	18.75	18.75	18.75
	151		19.25	19.25	19.25	19.25	19.25	19.25
	159		19.25	19.25	19.25	19.25	19.25	19.25
5 GHz WIFI 80 MHz Bandwidth	42		13.75	12.50	12.25	11.50	12.25	11.50
	58		14.00	13.50	13.50	13.00	13.50	13.00
	106		16.50	16.25	15.00	15.25	15.00	15.25
	122		18.75	18.75	18.75	18.75	18.75	18.75
	138		18.75	18.75	18.75	18.75	18.75	18.75
	155		18.50	17.75	18.50	17.75	18.50	17.75

Note: In MIMO operations, each antenna transmits at maximum allowed powers as indicated above.

Mode	IEEE 802.11 (Maximum in dBm) - Ant 2 Tolerance (+0/-3.00 dB)							
	Channel	SISO			MIMO CDD		MIMO SDM	
		a	n/ac	ax SU	a/n/ac	ax SU	n/ac	ax SU
5 GHz WIFI 20 MHz Bandwidth	36	18.00	18.00	17.75	16.50	16.50	16.50	16.50
	40	18.00	18.00	18.00	16.50	16.50	16.50	16.50
	44	18.00	18.00	18.00	16.50	16.50	16.50	16.50
	48	18.00	18.00	18.00	16.50	16.50	16.50	16.50
	52	17.75	17.75	17.75	16.50	16.50	16.50	16.50
	56	17.75	17.75	17.75	16.50	16.50	16.50	16.50
	60	17.75	17.75	17.75	16.50	16.50	16.50	16.50
	64	17.75	17.75	17.75	16.50	16.50	16.50	16.50
	100	18.25	18.25	18.25	16.50	16.50	16.50	16.50
	104	18.25	18.25	18.25	16.50	16.50	16.50	16.50
	108	18.25	18.25	18.25	16.50	16.50	16.50	16.50
	112	18.25	18.25	18.25	16.50	16.50	16.50	16.50
	116	18.25	18.25	18.25	16.50	16.50	16.50	16.50
	120	18.25	18.25	18.25	16.50	16.50	16.50	16.50
	124	18.25	18.25	18.25	16.50	16.50	16.50	16.50
	128	18.25	18.25	18.25	16.50	16.50	16.50	16.50
	132	18.25	18.25	18.25	16.50	16.50	16.50	16.50
	136	18.25	18.25	18.25	16.50	16.50	16.50	16.50
	140	16.00	16.00	16.00	16.00	16.00	16.00	16.00
	144	18.25	18.25	18.25	16.50	16.50	16.50	16.50
	149	18.75	18.75	18.75	18.75	18.75	18.75	18.75
	153	18.75	18.75	18.75	18.75	18.75	18.75	18.75
	157	18.75	18.75	18.75	18.75	18.75	18.75	18.75
	161	18.75	18.75	18.75	18.75	18.75	18.75	18.75
	165	18.75	18.75	18.75	18.75	18.75	18.75	18.75
5 GHz WIFI 40 MHz Bandwidth	38	[redacted]	15.25	14.25	15.00	13.25	15.00	13.25
	46		18.00	18.00	18.00	18.00	18.00	18.00
	54		17.75	17.75	17.75	17.75	17.75	17.75
	62		17.75	17.00	17.25	16.00	17.25	16.00
	102		16.50	16.25	16.00	14.75	16.00	14.75
	110		18.25	18.25	18.25	18.25	18.25	18.25
	118		18.25	18.25	18.25	18.25	18.25	18.25
	126		18.25	18.25	18.25	18.25	18.25	18.25
	134		18.25	18.25	18.25	18.25	18.25	18.25
	142		18.25	18.25	18.25	18.25	18.25	18.25
	151		18.75	18.75	18.75	18.75	18.75	18.75
	159		18.75	18.75	18.75	18.75	18.75	18.75
5 GHz WIFI 80 MHz Bandwidth	42		13.75	12.50	12.25	11.50	12.25	11.50
	58		14.00	13.50	13.50	13.00	13.50	13.00
	106		16.50	16.25	15.00	15.25	15.00	15.25
	122		18.25	18.25	18.25	18.25	18.25	18.25
	138		18.25	18.25	18.25	18.25	18.25	18.25
	155		18.50	17.75	18.50	17.75	18.50	17.75

Note: In MIMO operations, each antenna transmits at maximum allowed powers as indicated above.

1.3.2 Bluetooth Maximum and Reduced Output Power

Mode / Band		Modulated Average (ePA) - Single Tx Chain (dBm) - Antenna 1	Modulated Average (ePA) - TxBF (dBm) - Antenna 1
Bluetooth BDR	Maximum	**20.00**	**17.00**
	Nominal	**18.50**	**15.50**
Bluetooth EDR	Maximum	**13.50**	**13.50**
	Nominal	**12.00**	**12.00**
Bluetooth LE	Maximum	**7.00**	**7.00**
	Nominal	**5.50**	**5.50**
Bluetooth HDR	Maximum	**10.50**	**10.50**
	Nominal	**9.00**	**9.00**

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

Mode / Band		Modulated Average (iPA) - Single Tx Chain (dBm) - Antenna 1	Modulated Average (iPA) - TxBF (dBm) - Antenna 1
Bluetooth BDR	Maximum	**10.50**	**10.50**
	Nominal	**9.00**	**9.00**
Bluetooth EDR	Maximum	**6.50**	**6.50**
	Nominal	**5.00**	**5.00**
Bluetooth LE	Maximum	**7.00**	**7.00**
	Nominal	**5.50**	**5.50**
Bluetooth HDR	Maximum	**4.50**	**4.50**
	Nominal	**3.00**	**3.00**

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

Mode / Band		Modulated Average (ePA) - Single Tx Chain (dBm) - Antenna 2	Modulated Average (ePA) - TxBF (dBm) - Antenna 2
Bluetooth BDR	Maximum	**20.00**	**17.00**
	Nominal	**18.50**	**15.50**
Bluetooth EDR	Maximum	**13.50**	**13.50**
	Nominal	**12.00**	**12.00**
Bluetooth LE	Maximum	**9.00**	**7.00**
	Nominal	**7.50**	**5.50**
Bluetooth HDR	Maximum	**10.50**	**10.50**
	Nominal	**9.00**	**9.00**

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

Mode / Band		Modulated Average (iPA) - Single Tx Chain (dBm) - Antenna 2	Modulated Average (iPA) - TxBF (dBm) - Antenna 2
Bluetooth BDR	Maximum	**10.50**	**10.50**
	Nominal	**9.00**	**9.00**
Bluetooth EDR	Maximum	**6.50**	**6.50**
	Nominal	**5.00**	**5.00**
Bluetooth LE	Maximum	**9.00**	**7.00**
	Nominal	**7.50**	**5.50**
Bluetooth HDR	Maximum	**4.50**	**4.50**
	Nominal	**3.00**	**3.00**

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

Mode / Band		Modulated Average (iPA) - Single Tx Chain (dBm) - Antenna NB UNII_L	Modulated Average (iPA) - TxBF (dBm) - Antenna NB UNII_L
Bluetooth BDR	Maximum	**10.50**	**10.50**
	Nominal	**9.00**	**9.00**
Bluetooth EDR	Maximum	**6.50**	**6.50**
	Nominal	**5.00**	**5.00**
Bluetooth LE	Maximum	**9.00**	**7.00**
	Nominal	**7.50**	**5.50**
Bluetooth HDR	Maximum	**4.50**	**4.50**
	Nominal	**3.00**	**3.00**

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

Below table is applicable in the following conditions:
-Simultaneous conditions with 5 GHz WLAN active

Mode / Band		Modulated Average (ePA) - Single Tx Chain (dBm) - Antenna 1	Modulated Average (ePA) - TxBF (dBm) - Antenna 1
Bluetooth BDR Reduced	Maximum	**18.00**	**17.00**
	Nominal	**16.50**	**15.50**
Bluetooth EDR Reduced	Maximum	**13.50**	**13.50**
	Nominal	**12.00**	**12.00**
Bluetooth LE Reduced	Maximum	**7.00**	**7.00**
	Nominal	**5.50**	**5.50**
Bluetooth HDR Reduced	Maximum	**10.50**	**10.50**
	Nominal	**9.00**	**9.00**

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

Mode / Band		Modulated Average (iPA) - Single Tx Chain (dBm) - Antenna 1	Modulated Average (iPA) - TxBF (dBm) - Antenna 1
Bluetooth BDR	Maximum	**10.50**	**10.50**
	Nominal	**9.00**	**9.00**
Bluetooth EDR	Maximum	**6.50**	**6.50**
	Nominal	**5.00**	**5.00**
Bluetooth LE	Maximum	**7.00**	**7.00**
	Nominal	**5.50**	**5.50**
Bluetooth HDR	Maximum	**4.50**	**4.50**
	Nominal	**3.00**	**3.00**

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

Below table is applicable in the following conditions:
-Simultaneous conditions with 5 GHz WLAN active

Mode / Band		Modulated Average (ePA) - Single Tx Chain (dBm) - Antenna 2	Modulated Average (ePA) - TxBF (dBm) - Antenna 2
Bluetooth BDR Reduced	Maximum	**18.00**	**17.00**
	Nominal	**16.50**	**15.50**
Bluetooth EDR Reduced	Maximum	**13.50**	**13.50**
	Nominal	**12.00**	**12.00**
Bluetooth LE Reduced	Maximum	**9.00**	**7.00**
	Nominal	**7.50**	**5.50**
Bluetooth HDR Reduced	Maximum	**10.50**	**10.50**
	Nominal	**9.00**	**9.00**

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

Mode / Band		Modulated Average (iPA) - Single Tx Chain (dBm) - Antenna 2	Modulated Average (iPA) - TxBF (dBm) - Antenna 2
Bluetooth BDR	Maximum	**10.50**	**10.50**
	Nominal	**9.00**	**9.00**
Bluetooth EDR	Maximum	**6.50**	**6.50**
	Nominal	**5.00**	**5.00**
Bluetooth LE	Maximum	**9.00**	**7.00**
	Nominal	**7.50**	**5.50**
Bluetooth HDR	Maximum	**4.50**	**4.50**
	Nominal	**3.00**	**3.00**

Note: In TxBF operations, each antenna transmits at maximum allowed powers as indicated above.

1.3.1 NB UNII Maximum Power

Mode / Band		Modulated Average (ePA) - Single Tx Chain (dBm) - Antenna NB UNII_R
NB UNII-1 BDR	Maximum	**5.50**
	Nominal	**4.00**
NB UNII-1 HDR	Maximum	**2.50**
	Nominal	**1.00**
NB UNII-1 LE	Maximum	**5.50**
	Nominal	**4.00**

Mode / Band		Modulated Average (ePA) - Single Tx Chain (dBm) - Antenna NB UNII_L
NB UNII-1 BDR	Maximum	**5.50**
	Nominal	**4.00**
NB UNII-1 HDR	Maximum	**2.50**
	Nominal	**1.00**
NB UNII-1 LE	Maximum	**5.50**
	Nominal	**4.00**

Mode / Band		Modulated Average (ePA) - Single Tx Chain (dBm) - Antenna NB UNII_R
NB UNII-3 BDR	Maximum	**5.50**
	Nominal	**4.00**
NB UNII-3 HDR	Maximum	**2.50**
	Nominal	**1.00**
NB UNII-3 LE	Maximum	**5.50**
	Nominal	**4.00**

Mode / Band		Modulated Average (ePA) - Single Tx Chain (dBm) - Antenna NB UNII_L
NB UNII-3 BDR	Maximum	**5.50**
	Nominal	**4.00**
NB UNII-3 HDR	Maximum	**2.50**
	Nominal	**1.00**
NB UNII-3 LE	Maximum	**5.50**
	Nominal	**4.00**

1.4 DUT Antenna Locations

Based on the expected use conditions and FCC approved test plan, Head SAR and Extremity SAR were evaluated. A diagram showing the location of the antennas can be found in the DUT Antenna Diagram & SAR Test Setup Photographs appendix. More information about the configuration evaluated for SAR can be found in Section 4.2 and Section 4.3.

1.5 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01v06, transmitters are considered to be operating simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 60 seconds.

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v06 4.3.2 procedures.

Table 1-1
Simultaneous Head Transmission Scenarios

No.	Capable Transmit Configuration	Head
1	NB UNII + 2.4 GHz Bluetooth	Yes
2	NB UNII + 2.4 GHz WiFi	Yes
3	NB UNII + 5 GHz WiFi	Yes
4	NB UNII + 2.4 GHz Bluetooth + 5GHz WiFi	Yes
5	NB UNII + 2.4 GHz Bluetooth + 2.4GHz WiFi	Yes
7	2.4 GHz Bluetooth + 2.4 GHz WI-FI	Yes
9	2.4 GHz Bluetooth + 5 GHz WI-FI	Yes
8	2.4 GHz Bluetooth(TXBF)	Yes
9	2.4 GHz Bluetooth(TXBF) + 5 GHz WI-FI	Yes

Table 1-2
Simultaneous Extremity Transmission Scenarios

No.	Capable Transmit Configuration	Extremity
1	NB UNII + 2.4 GHz Bluetooth	Yes
2	NB UNII + 2.4 GHz WiFi	Yes
3	NB UNII + 5 GHz WiFi	Yes
4	NB UNII + 2.4 GHz Bluetooth + 5GHz WiFi	Yes
5	NB UNII + 2.4 GHz Bluetooth + 2.4GHz WiFi	Yes
7	2.4 GHz Bluetooth + 2.4 GHz WI-FI	Yes
9	2.4 GHz Bluetooth + 5 GHz WI-FI	Yes
8	2.4 GHz Bluetooth(TXBF)	Yes
9	2.4 GHz Bluetooth(TXBF) + 5 GHz WI-FI	Yes
11	2.4 GHz WLAN MIMO	Yes
12	5 GHz WLAN MIMO	Yes

1. 2.4 GHz WLAN, and 2.4 GHz Bluetooth can transmit simultaneously on separate antennas. 2.4 GHz WLAN Antenna 1 can only transmit simultaneously with 2.4 GHz Bluetooth Antenna 2 **or** 2.4 GHz Bluetooth Antenna NB UNII_L.
2. This device supports VoWIFI.
3. NB UNII Antennas are on the same core and will always operate at the same time.
4. Table 1-1 supports Head testing using the Head-on policy as stated in the Technical Document.
5. Table 1-2 supports Extremity testing using both Head-on and Head-off policies as stated in the Technical Document.

1.6 Miscellaneous SAR Test Considerations

(A) WIFI/BT

Based on the maximum allowed power for the respective antennas, U-NII-1 was evaluated for Antenna 2 and U-NII-2A was evaluated for Antenna 1. Additional testing for U-NII-2A Antenna 2 and for U-NII-1 Antenna 1 SAR was not required since all reported SAR was less than 1.2 W/kg per FCC KDB Publication 248227 D01v02r02.

The WLAN/Bluetooth chipset in this device is produced by two different suppliers. The electrically identical modules are manufactured with the identical mechanical structure to meet the same specifications and functions. Two device variants are referenced as Variant 1 and Variant 2 in this report. WLAN/Bluetooth SAR worst case configuration was spot checked on Variant 1 and Variant 2.

This device supports channel 1-13 for 2.4 GHz WLAN. However, because channel 12/13 targets are not higher than that of channels 1-11, channels 1, 6, and 11 were considered for SAR testing per FCC KDB 248227 D01V02r02.

This device supports IEEE 802.11ac with the following features:

a) Up to 80 MHz Bandwidth only for 5 GHz
b) 2 Tx antenna output
c) 256 QAM is supported
d) TDWR and Band gap channels are supported

This device supports IEEE 802.11ax with the following features:

a) Up to 80 MHz Bandwidth only for 5 GHz
b) Up to 20 MHz Bandwidth only for 2.4 GHz
c) 2 Tx antenna output
d) Up to 1024 QAM is supported
e) TDWR and Band gap channels are supported for 5 GHz
f) MU-MIMO UL Operations are not supported

Per April 2019 TCB Workshop Notes, SAR testing was not required for 802.11ax when applying the initial test configuration procedures of KDB 248227, with 802.11ax considered a higher order 802.11 mode.

1.7 Guidance Applied

- FCC KDB Publication 248227 D01v02r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v06 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r04, D02v01r02 (SAR Measurements up to 6 GHz)
- April 2019 TCB Workshop Notes (IEEE 802.11ax)

1.8 Device Serial Numbers

Several samples with identical hardware were used to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical, and thermal characteristics and are within operational tolerances expected for production units. The serial numbers used for each test are indicated alongside the results in Section 9.

2 INTRODUCTION

The FCC and Innovation, Science, and Economic Development Canada have adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 and Health Canada Safety Code 6 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. [1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [22]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

2.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 2-1).

Equation 2-1
SAR Mathematical Equation

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho dv}\right)$$

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

σ = conductivity of the tissue-simulating material (S/m)
ρ = mass density of the tissue-simulating material (kg/m^3)
E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

3 DOSIMETRIC ASSESSMENT

3.1 Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01r04 and IEEE 1528-2013:

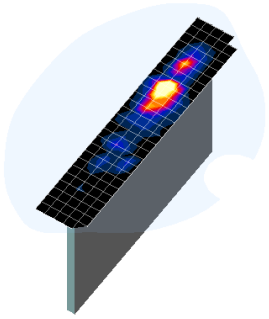


Figure 3-1
Sample SAR Area Scan

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01r04 (See Table 3-1) and IEEE 1528-2013.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01r04 (See Table 3-1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the cDASY6 manual online for more details):

   a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 3-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).

   b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.

   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

Table 3-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04*

Frequency	Maximum Area Scan Resolution (mm) (Δx_{area}, Δy_{area})	Maximum Zoom Scan Resolution (mm) (Δx_{zoom}, Δy_{zoom})	Maximum Zoom Scan Spatial Resolution (mm)			Minimum Zoom Scan Volume (mm) (x,y,z)
			Uniform Grid	Graded Grid		
			$\Delta z_{zoom}(n)$	$\Delta z_{zoom}(1)$*	$\Delta z_{zoom}(n>1)$*	
≤ 2 GHz	≤ 15	≤ 8	≤ 5	≤ 4	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≤ 4	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≤ 3	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≤ 2.5	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 25
5-6 GHz	≤ 10	≤ 4	≤ 2	≤ 2	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 22

*Also compliant to IEEE 1528-2013 Table 6

4 TEST CONFIGURATION POSITIONS

4.1 Device Holder

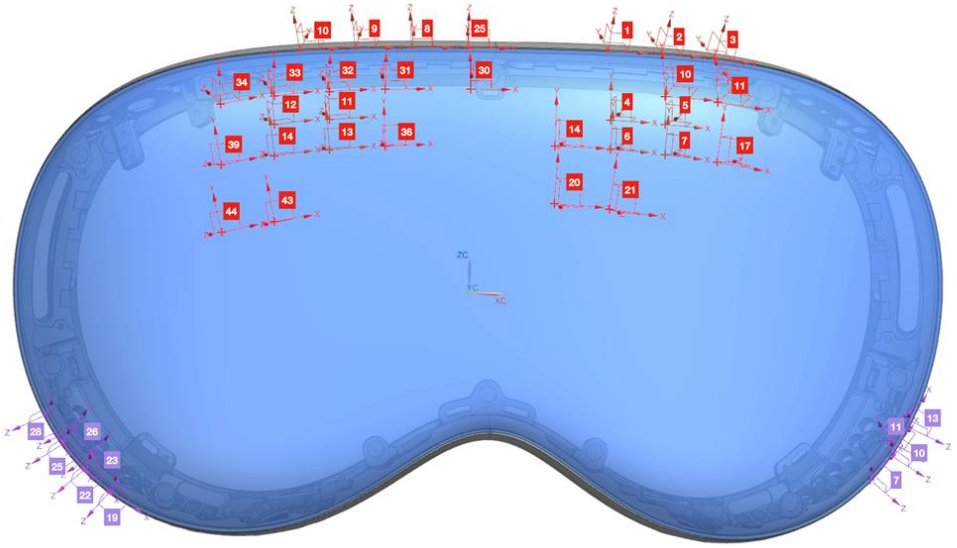
The device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 0.02.

4.2 Positioning for Head

Head mounted devices are designed to be used on the face and, in particular, the eye regions. Since the device is worn in front of the face, SAR testing was performed in a face-down phantom to evaluate all head use case conditions. SAR was evaluated with a separation distance of 0 mm between the device and the eye region of the facedown phantom to mimic expected use conditions. Additionally, the worst-case SAR configuration per band (e.g. 2400-2483.5 MHz, 5150-5250 MHz etc.) was spot-checked with the light seal which is a foam gasket covered in fabric connected to the head mounted device to ensure a good fit and seal out the ambient light. The smallest and largest light seal available were used for the spot-check. The phantom is filled with head tissue equivalent medium.

4.3 Extremity Exposure Conditions

Devices that are designed or intended for use on extremities or mainly operated in extremity only exposure conditions: i.e., hands, wrists, feet, and ankles, may require an extremity SAR evaluation. Per FCC approved test plan, Extremity SAR was evaluated. Based on the simulation data, a few candidates for the maximum averaged E-field location/area on the surface of the device were identified. A tangential plane on the maximum E-field locations were identified and a URE5 Robot was used to position the device in these locations underneath the flat phantom so SAR can be evaluated to confirm the highest SAR value. The separation distance between the device and the flat phantom was 0 mm. A diagram of the locations identified (point scheme schematic) per antenna is shown below. Additionally, the worst-case SAR configuration per band (e.g. 2400-2483.5 MHz, 5150-5250 MHz etc.) was spot-checked with the light seal, which is a foam gasket covered in fabric connected to the head mounted device to ensure a good fit and seal out ambient light. The smallest (“mini”) and largest (“main”) available light seals were used for the spot-check. The phantom is filled with head tissue-equivalent medium.



5 RF EXPOSURE LIMITS

5.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

5.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e., as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 5-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
Peak Spatial Average SAR Head	1.6	8.0
Whole Body SAR	0.08	0.4
Peak Spatial Average SAR Hands, Feet, Ankle, Wrists, etc.	4.0	20

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

6 FCC MEASUREMENT PROCEDURES

6.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v06, when SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* SAR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r03.

6.1.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters.

A periodic duty factor is required for current generation SAR systems to measure SAR. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. The reported SAR is scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

6.1.2 U-NII-1 and U-NII-2A

For devices that operate in both U-NII-1 and U-NII-2A bands, when the same maximum output power is specified for both bands, SAR measurement using OFDM SAR test procedures is not required for U-NII-1 unless the highest reported SAR for U-NII-2A is > 1.2 W/kg. When different maximum output powers are specified for the bands, SAR measurement for the U-NII band with the lower maximum output power is not required unless the highest reported SAR for the U-NII band with the higher maximum output power, adjusted by the ratio of lower to higher specified maximum output power for the two bands, is > 1.2 W/kg. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

6.1.3 U-NII-2C and U-NII-3

The frequency range covered by U-NII-2C and U-NII-3 is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. When Terminal Doppler Weather Radar (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification. Unless band gap channels are permanently disabled, SAR must be considered for these channels. Each band is tested independently according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

6.1.4 2.4 GHz SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either the fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

2) When the reported SAR is > 0.8 W/kg, SAR is required for that position using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

2.4 GHz 802.11 g/n/ax OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is > 1.2 W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

7 RF CONDUCTED POWERS

7.1 WLAN Maximum Time-Averaged Conducted Powers

Table 7-1
2.4 GHz WLAN Maximum Average RF Power – Ant 1, Variant 1

2.4GHz Conducted Power [dBm]					
Freq [MHz]	Channel	IEEE Transmission Mode			
		802.11b	802.11g	802.11n	802.11ax (SU)
		Average	Average	Average	Average
2412	1	18.93	17.90	17.80	16.70
2417	2	20.48	18.50	18.65	18.66
2437	6	20.55	20.50	20.50	21.00
2462	11	20.57	17.86	17.85	16.88

Table 7-2
2.4 GHz WLAN Maximum Average RF Power – Ant 1, Variant 2

2.4GHz Conducted Power [dBm]					
Freq [MHz]	Channel	IEEE Transmission Mode			
		802.11b	802.11g	802.11n	802.11ax (SU)
		Average	Average	Average	Average
2412	1	19.05	17.22	17.39	16.40
2417	2	20.50	18.43	18.35	18.08
2437	6	20.64	20.89	20.87	20.39
2462	11	20.43	17.47	17.77	17.20

Table 7-3
2.4 GHz WLAN Maximum Average RF Power – Ant 2, Variant 1

2.4GHz Conducted Power [dBm]					
Freq [MHz]	Channel	IEEE Transmission Mode			
		802.11b	802.11g	802.11n	802.11ax (SU)
		Average	Average	Average	Average
2412	1	19.08	17.75	17.63	16.50
2417	2	20.46	18.35	18.40	18.58
2437	6	20.50	20.47	20.50	21.00
2462	11	20.55	17.57	17.55	16.60

Table 7-4
2.4 GHz WLAN Maximum Average RF Power – Ant 2, Variant 2

2.4GHz Conducted Power [dBm]					
Freq [MHz]	Channel	IEEE Transmission Mode			
		802.11b	802.11g	802.11n	802.11ax (SU)
		Average	Average	Average	Average
2412	1	19.09	17.39	17.40	16.37
2417	2	20.42	18.20	18.45	18.60
2437	6	20.53	20.66	20.63	20.24
2462	11	20.53	17.51	17.47	17.20

Table 7-5
5 GHz WLAN Maximum Average RF Power – Ant 1, Variant 1

5GHz (40MHz) Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11n	802.11ac	802.11ax (SU)
		Average	Average	Average
5190	38	14.67	14.58	13.27
5230	46	17.68	17.40	17.85
5270	54	17.54	17.38	18.00
5310	62	16.21	16.55	16.21
5755	151	18.03	18.34	18.48
5795	159	18.02	18.75	18.83

5GHz (80MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11ac	802.11ax (SU)
		Average	Average
5530	106	15.51	15.74
5610	122	17.04	17.73
5690	138	17.06	18.08

Table 7-6
5 GHz WLAN Maximum Average RF Power – Ant 1, Variant 2

5GHz (40MHz) Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11n	802.11ac	802.11ax (SU)
		Average	Average	Average
5190	38	14.85	13.63	13.67
5230	46	17.59	18.10	17.94
5270	54	17.58	17.80	17.84
5310	62	16.34	16.47	16.53
5755	151	18.09	18.37	18.24
5795	159	18.05	18.77	18.68

5GHz (80MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11ac	802.11ax (SU)
		Average	Average
5530	106	15.45	15.93
5610	122	17.02	17.89
5690	138	16.92	17.10

Table 7-7
5 GHz WLAN Maximum Average RF Power – Ant 2, Variant 1

5GHz (40MHz) Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11n	802.11ac	802.11ax (SU)
		Average	Average	Average
5190	38	14.27	14.40	13.68
5230	46	17.75	17.16	17.17
5270	54	17.72	17.14	17.00
5310	62	16.69	16.97	16.10
5755	151	17.98	17.52	17.78
5795	159	18.01	18.10	17.86

5GHz (80MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11ac	802.11ax (SU)
		Average	Average
5530	106	15.46	15.45
5610	122	16.46	17.50
5690	138	16.49	17.66

Table 7-8
5 GHz WLAN Maximum Average RF Power – Ant 2, Variant 2

5GHz (40MHz) Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11n	802.11ac	802.11ax (SU)
		Average	Average	Average
5190	38	14.40	14.10	13.29
5230	46	17.66	17.12	17.30
5270	54	17.70	16.40	16.46
5310	62	16.66	16.30	16.09
5755	151	17.99	17.50	17.74
5795	159	18.00	18.08	18.00

5GHz (80MHz) Conducted Power [dBm]			
Freq [MHz]	Channel	IEEE Transmission Mode	
		802.11ac	802.11ax (SU)
		Average	Average
5530	106	15.49	15.63
5610	122	16.44	17.80
5690	138	16.48	17.75

7.2 Notes for WLAN

Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02:

- Power measurements were performed for the transmission mode configuration with the highest maximum output power specified for production units.
- For transmission modes with the same maximum output power specification, powers were measured for the largest channel bandwidth, lowest order modulation and lowest data rate.
- For transmission modes with identical maximum specified output power, channel bandwidth, modulation and data rates, power measurements were required for all identical configurations.
- For each transmission mode configuration, powers were measured for the highest and lowest channels; and at the mid-band channel(s) when there were at least 3 channels supported. For configurations with multiple mid-band channels, due to an even number of channels, both channels were measured.
- The WLAN chipset in this device is produced by two different suppliers. The electrically identical modules are manufactured with the identical mechanical structure to meet the same specifications and functions.
- Two device variants are referenced as Variant 1 and Variant 2 in this report.
- WLAN/Bluetooth SAR worst case configuration was spot checked on Variant 1 and Variant 2.

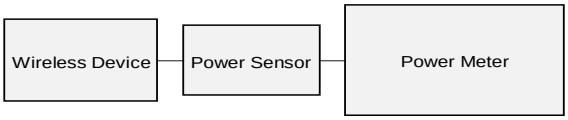


Figure 7-1
Power Measurement Setup

7.3 Bluetooth Conducted Powers

Table 7-9
Bluetooth Average RF Power – Ant 1, Variant 1

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	18.61	72.611
2441	GFSK	1.0	39	18.54	71.450
2480	GFSK	1.0	78	18.60	72.444

Table 7-10
Bluetooth Average RF Power – Ant 1, Variant 2

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	18.65	73.282
2441	GFSK	1.0	39	18.60	72.444
2480	GFSK	1.0	78	18.44	69.823

Table 7-11
Bluetooth Average RF Power – Ant 2, Variant 1

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	18.64	73.114
2441	GFSK	1.0	39	18.60	72.444
2480	GFSK	1.0	78	18.62	72.778

Table 7-12
Bluetooth Average RF Power – Ant 2, Variant 2

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	18.65	73.282
2441	GFSK	1.0	39	18.61	72.611
2480	GFSK	1.0	78	18.63	72.946

Table 7-13
Bluetooth Average RF Power – Ant NB UNII_L, Variant 1

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	10.49	11.194
2441	GFSK	1.0	39	10.50	11.220
2480	GFSK	1.0	78	10.47	11.143

Table 7-14
Bluetooth Average RF Power – Ant NB UNII_L, Variant 2

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	10.00	10.000
2441	GFSK	1.0	39	10.35	10.839
2480	GFSK	1.0	78	10.34	10.814

Table 7-15
NB UNII Average RF Power – Ant NB UNII_R, Variant 1

Band	Frequency	Average
UNII1	5157	4.71
	5201	4.71
	5245	4.64
UNII3	5731	4.62
	5788	4.54
	5844	4.46

Table 7-16
NB UNII Average RF Power – Ant NB UNII_R, Variant 2

Band	Frequency	Average
UNII1	5157	4.49
	5201	4.52
	5245	4.52
UNII3	5731	4.75
	5788	4.74
	5844	4.60

Table 7-17
NB UNII Average RF Power – Ant NB UNII_L, Variant 1

Band	Frequency	Average
UNII1	5157	4.60
	5201	4.77
	5245	4.75
UNII3	5731	4.55
	5788	4.61
	5844	4.48

Table 7-18
NB UNII Average RF Power – Ant NB UNII_L, Variant 2

Band	Frequency	Average
UNII1	5157	4.58
	5201	4.71
	5245	4.60
UNII3	5731	4.69
	5788	4.51
	5844	4.55

7.1 Bluetooth Reduced Conducted Powers

Table 7-19
Bluetooth 2 dB Reduced Average RF Power – Ant 1, Variant 1

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	16.58	45.499
2441	GFSK	1.0	39	16.70	46.774
2480	GFSK	1.0	78	16.75	47.315

Table 7-20
Bluetooth 2 dB Reduced Average RF Power – Ant 1, Variant 2

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	17.21	52.602
2441	GFSK	1.0	39	17.14	51.761
2480	GFSK	1.0	78	16.90	48.978

Table 7-21
Bluetooth 2 dB Reduced Average RF Power – Ant 2, Variant 1

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	16.55	45.186
2441	GFSK	1.0	39	16.74	47.206
2480	GFSK	1.0	78	16.92	49.204

Table 7-22
Bluetooth 2 dB Reduced Average RF Power – Ant 2, Variant 2

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	16.94	49.431
2441	GFSK	1.0	39	17.03	50.466
2480	GFSK	1.0	78	17.13	51.642

7.2 Bluetooth Duty Cycle

7.2.1 Maximum Bluetooth Transmission

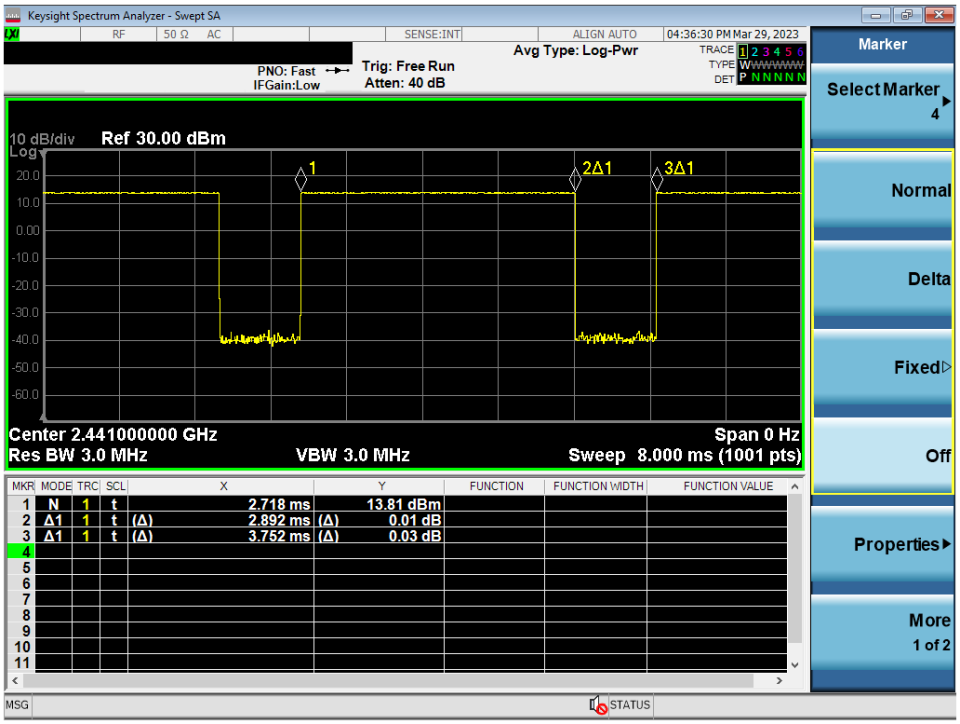


Figure 7-2
2.4 GHz Bluetooth Transmission Plot – Antenna 1, Variant 1

Equation 7-1
2.4 GHz Bluetooth Duty Cycle Calculation – Antenna 1, Variant 1

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.892\ ms}{3.752\ ms} * 100\% = 77.1\%$$

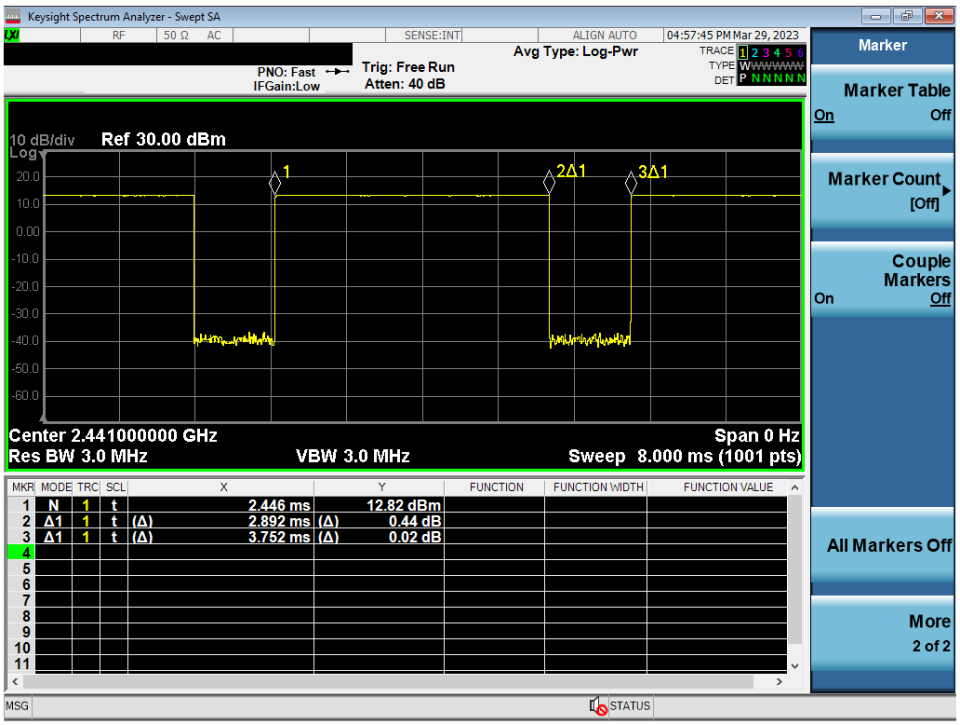


Figure 7-3
2.4 GHz Bluetooth Transmission Plot – Antenna 1, Variant 2

Equation 7-2
2.4 GHz Bluetooth Duty Cycle Calculation – Antenna 1, Variant 2

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.892\ ms}{3.752\ ms} * 100\% = 77.1\%$$

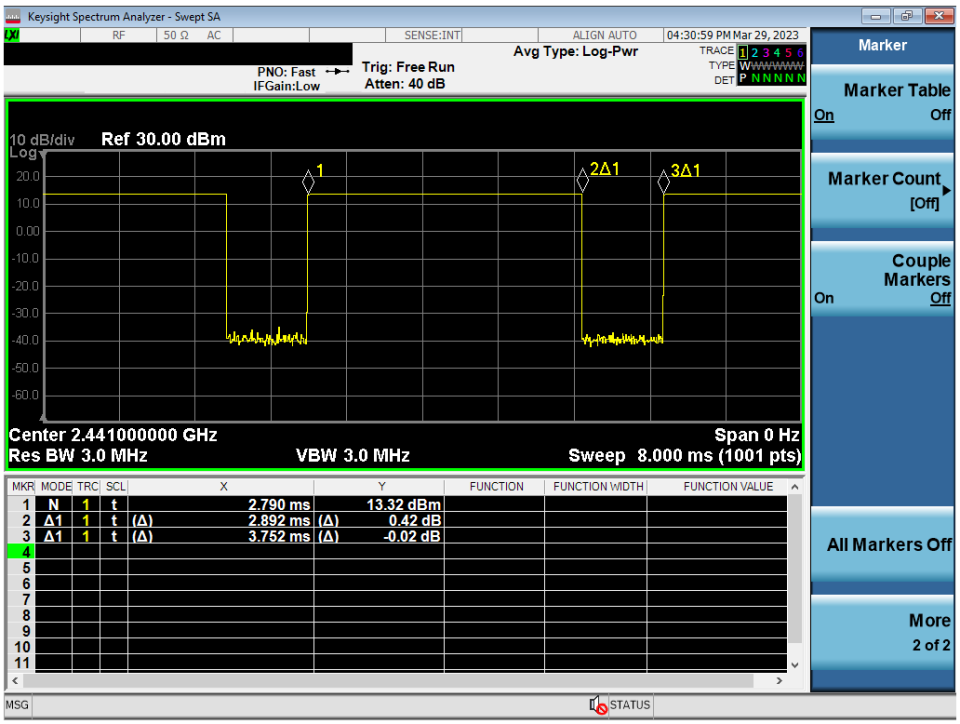


Figure 7-4
2.4 GHz Bluetooth Transmission Plot – Antenna 2, Variant 1

Equation 7-3
2.4 GHz Bluetooth Duty Cycle Calculation – Antenna 2, Variant 1

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.892\ ms}{3.752\ ms} * 100\% = 77.1\%$$

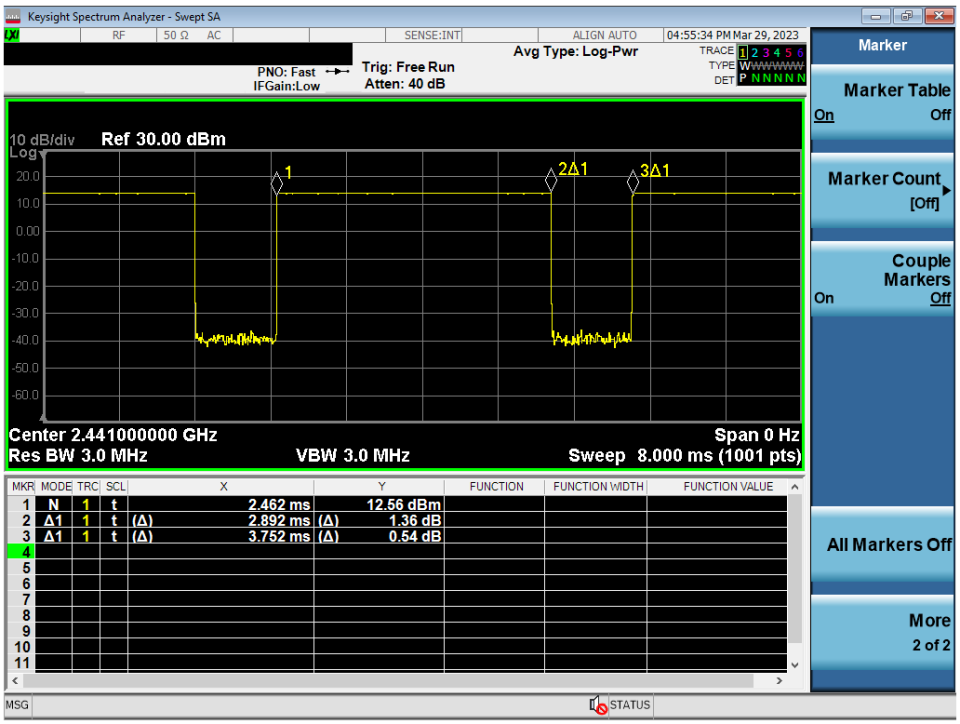


Figure 7-5
2.4 GHz Bluetooth Transmission Plot – Antenna 2, Variant 2

Equation 7-4
2.4 GHz Bluetooth Duty Cycle Calculation – Antenna 2, Variant 2

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.892\ ms}{3.752\ ms} * 100\% = 77.1\%$$

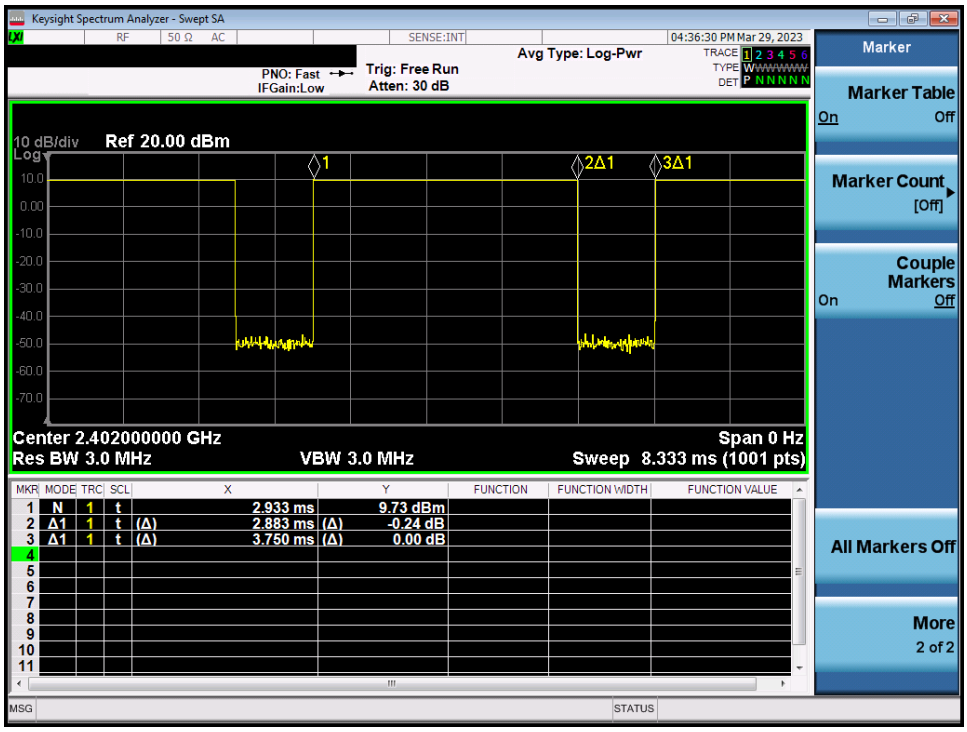


Figure 7-6
2.4 GHz Bluetooth Transmission Plot – Antenna NB UNII_L, Variant 1

Equation 7-5
2.4 GHz Bluetooth Duty Cycle Calculation – Antenna NB UNII_L, Variant 1

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.883\ ms}{3.750\ ms} * 100\% = 76.9\%$$

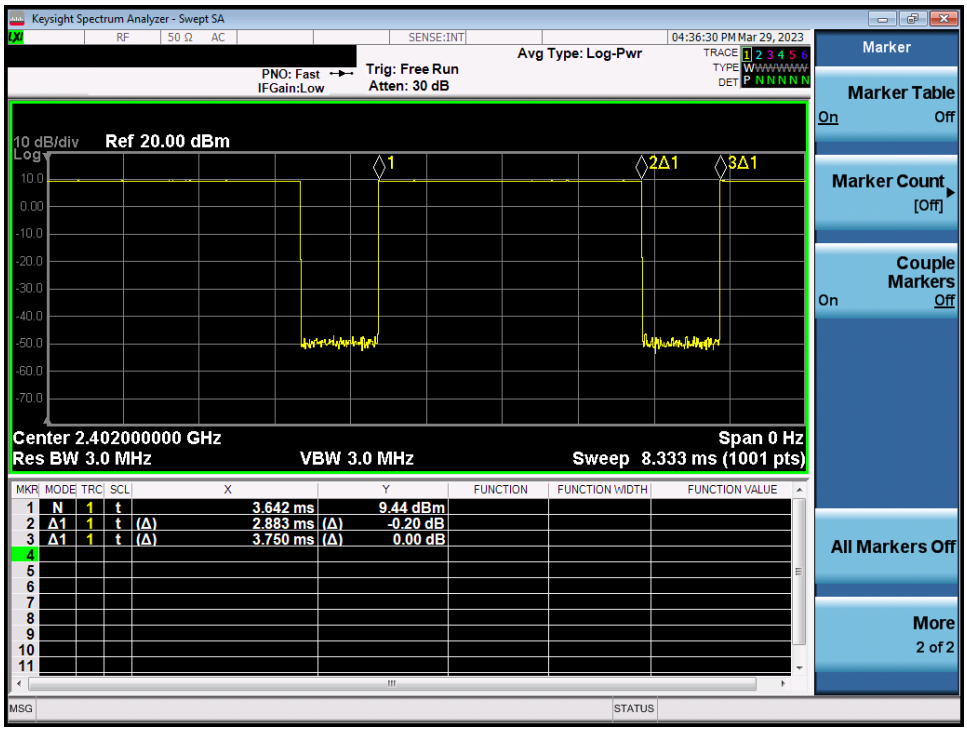


Figure 7-7
2.4 GHz Bluetooth Transmission Plot – Antenna NB UNII_L, Variant 2

Equation 7-6
2.4 GHz Bluetooth Duty Cycle Calculation – Antenna NB UNII_L, Variant 2

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.883\ ms}{3.750\ ms} * 100\% = 76.9\%$$

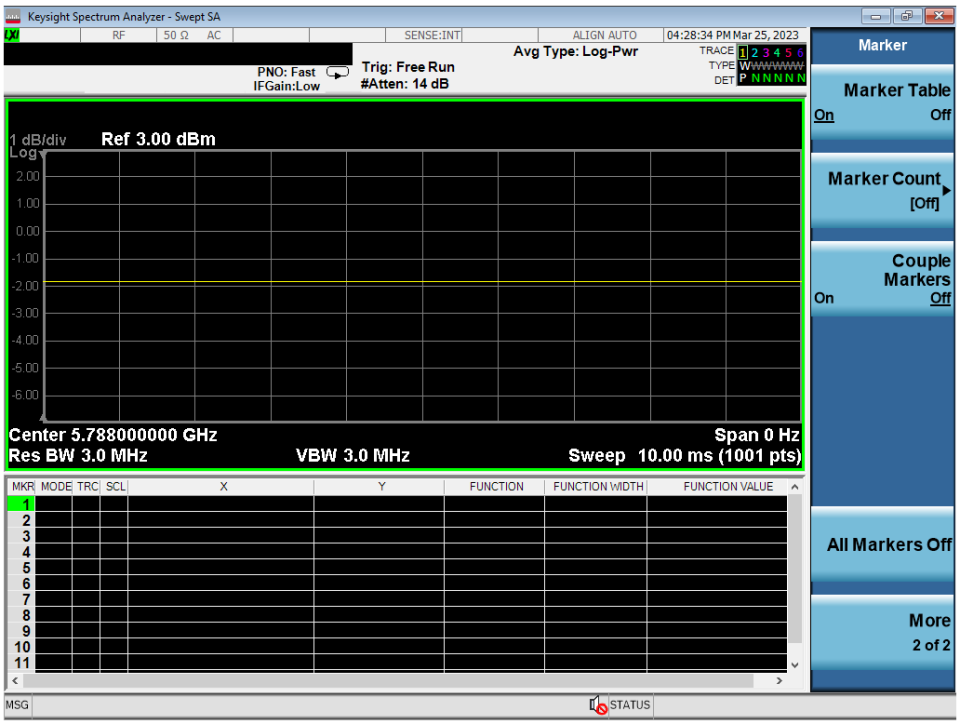


Figure 7-8
NB UNII Transmission Plot – Antenna NB UNII_R, Variant 1

Equation 7-7
NB UNII Duty Cycle Calculation – Antenna NB UNII_R, Variant 1

$$Duty\ Cycle = 100\%$$

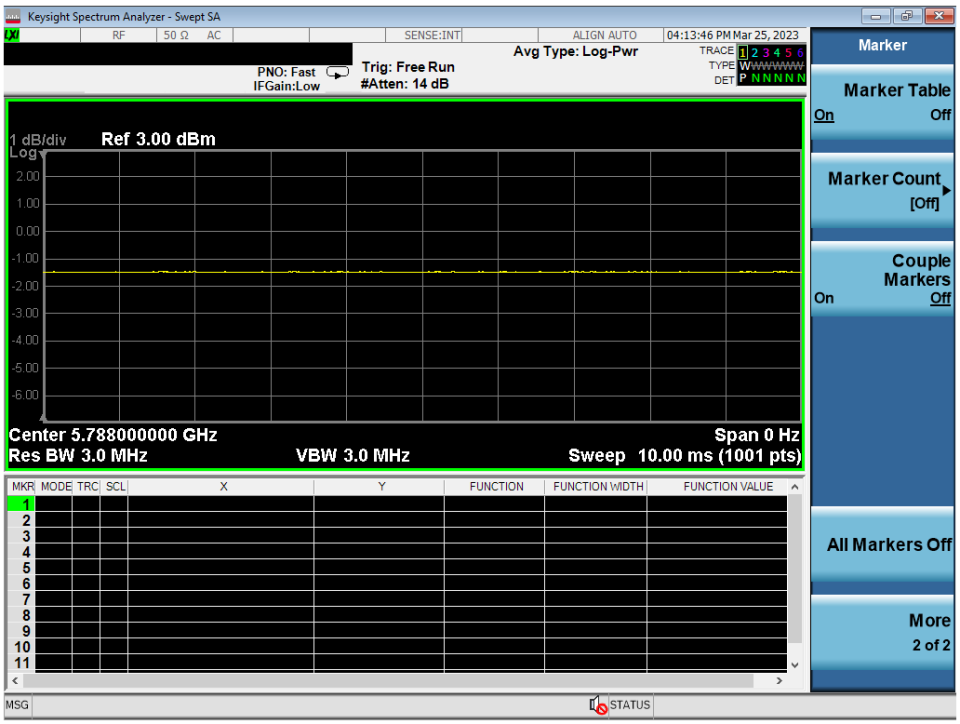


Figure 7-9
NB UNII Transmission Plot – Antenna NB UNII_R, Variant 2

Equation 7-8
NB UNII Duty Cycle Calculation – Antenna NB UNII_R, Variant 2

$$Duty\ Cycle = 100\%$$

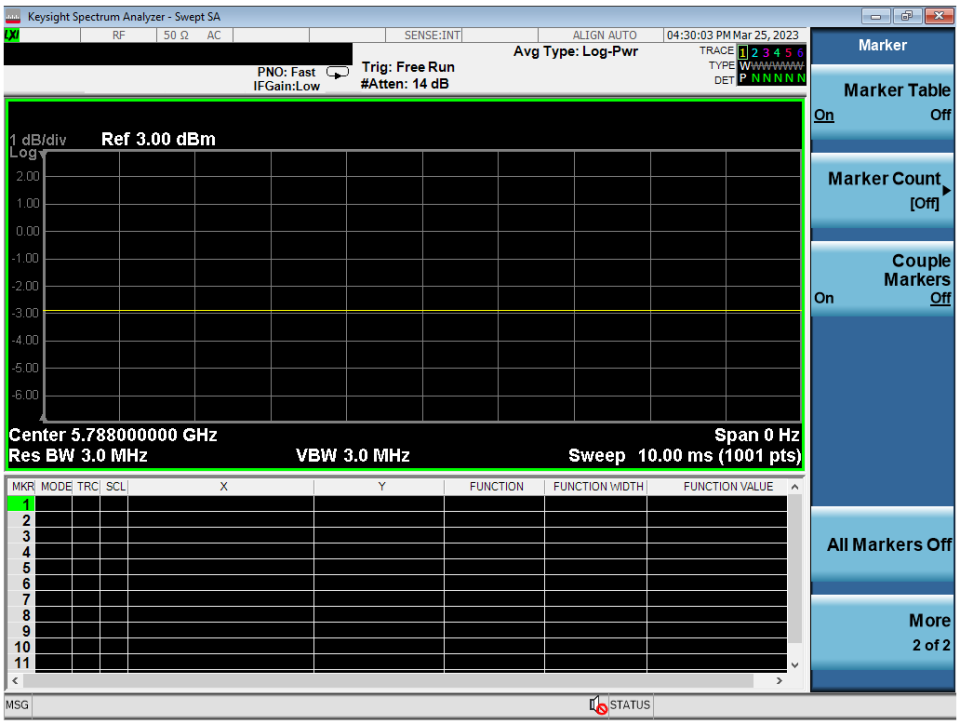


Figure 7-10
NB UNII Transmission Plot – Antenna NB UNII_L, Variant 1

Equation 7-9
NB UNII Duty Cycle Calculation – Antenna NB UNII_L, Variant 1

$$Duty\ Cycle = 100\%$$

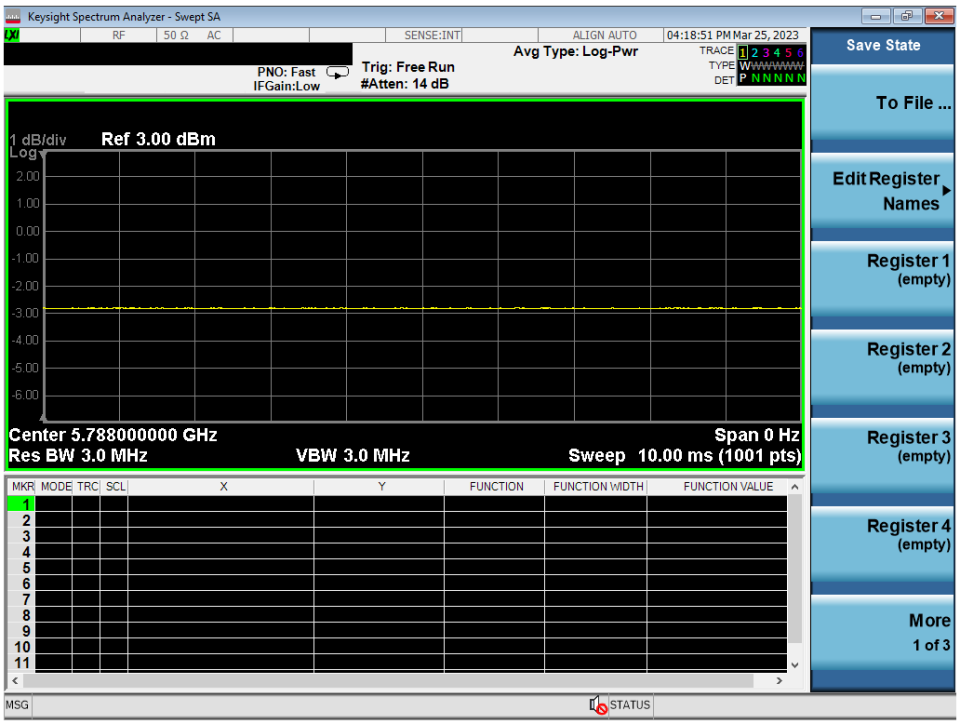


Figure 7-11
NB UNII Transmission Plot – Antenna NB UNII_L, Variant 2

Equation 7-10
NB UNII Duty Cycle Calculation – Antenna NB UNII_L, Variant 2

$$Duty\ Cycle = 100\%$$

7.3 Bluetooth Power Reduction Verification Summary

Table 7-23
Bluetooth Power Reduction Verification

Antenna	Mode/Band	Condition (s)	Maximum Scenario Maximum Allowed Tune Up Power [dBm]	Reduced Scenario Maximum Allowed Tune Up Power [dBm]	Maximum Measured Power [dBm]	Reduced Measured Power [dBm]	Verdict
ANT 1	2.4 GHz Bluetooth	5GHz WLAN Ant 1/2	20	18	19.74	17.04	PASS
ANT 2	2.4 GHz Bluetooth	5GHz WLAN Ant 1/2	20	18	18.83	16.99	PASS

Conducted powers were measured for each Mode/Band and applied condition. All conducted power measurements were verified to be below the maximum allowed.

7.4 Notes for Bluetooth

- The Bluetooth chipset in this device is produced by two different suppliers. The electrically identical modules are manufactured with the identical mechanical structure to meet the same specifications and functions. Two device variants are referenced as Variant 1 and Variant 2 in this report.
- Full power measurements were performed for Variant 1 and Variant 2 per FCC KDB Procedures 248227.
- WLAN/Bluetooth SAR worst case configuration was spot checked on Variant 1 and Variant 2.

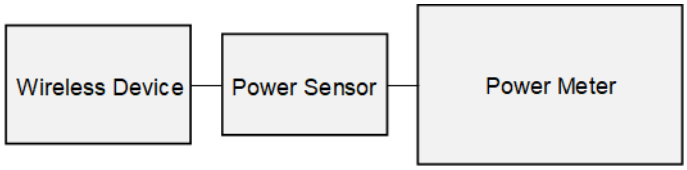


Figure 7-12
Power Measurement Setup

8 SYSTEM VERIFICATION

8.1 Tissue Verification

Table 8-1
Measured Head Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (˚C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	%dev σ	%dev ε
2/28/2023	2450 Head	19.7	2300	1.749	38.818	1.670	39.500	*4.73%*	*-1.73%*
			2310	1.758	38.801	1.679	39.480	*4.71%*	*-1.72%*
			2320	1.766	38.788	1.687	39.460	*4.68%*	*-1.70%*
			2400	1.829	38.630	1.756	39.289	*4.16%*	*-1.68%*
			2450	1.871	38.533	1.800	39.200	*3.94%*	*-1.70%*
			2480	1.894	38.476	1.833	39.162	*3.33%*	*-1.75%*
			2500	1.910	38.429	1.855	39.136	*2.96%*	*-1.81%*
			2510	1.919	38.407	1.866	39.123	*2.84%*	*-1.83%*
			2535	1.941	38.358	1.893	39.092	*2.54%*	*-1.88%*
			2550	1.954	38.327	1.909	39.073	*2.36%*	*-1.91%*
			2560	1.962	38.306	1.920	39.060	*2.19%*	*-1.93%*
			2600	1.995	38.220	1.964	39.009	*1.58%*	*-2.02%*
			2650	2.040	38.107	2.018	38.945	*1.09%*	*-2.15%*
			2680	2.065	38.047	2.051	38.907	*0.68%*	*-2.21%*
			2700	2.080	38.007	2.073	38.882	*0.34%*	*-2.25%*
3/1/2023	2450 Head	20.6	2300	1.746	40.140	1.670	39.500	*4.55%*	*1.62%*
			2310	1.753	40.119	1.679	39.480	*4.41%*	*1.62%*
			2320	1.762	40.102	1.687	39.460	*4.45%*	*1.63%*
			2400	1.827	39.970	1.756	39.289	*4.04%*	*1.73%*
			2450	1.870	39.870	1.800	39.200	*3.89%*	*1.71%*
			2480	1.892	39.816	1.833	39.162	*3.22%*	*1.67%*
			2500	1.907	39.780	1.855	39.136	*2.80%*	*1.65%*
			2510	1.916	39.764	1.866	39.123	*2.68%*	*1.64%*
			2535	1.939	39.726	1.893	39.092	*2.43%*	*1.62%*
			2550	1.952	39.690	1.909	39.073	*2.25%*	*1.58%*
			2560	1.960	39.668	1.920	39.060	*2.08%*	*1.56%*
			2600	1.993	39.593	1.964	39.009	*1.48%*	*1.50%*
			2650	2.039	39.499	2.018	38.945	*1.04%*	*1.42%*
			2680	2.063	39.447	2.051	38.907	*0.59%*	*1.39%*
			2700	2.079	39.409	2.073	38.882	*0.29%*	*1.36%*
3/2/2023	2450 Head	20.2	2300	1.744	38.947	1.670	39.500	*4.43%*	*-1.40%*
			2310	1.752	38.928	1.679	39.480	*4.35%*	*-1.40%*
			2320	1.759	38.910	1.687	39.460	*4.27%*	*-1.39%*
			2400	1.820	38.781	1.756	39.289	*3.64%*	*-1.29%*
			2450	1.857	38.687	1.800	39.200	*3.17%*	*-1.31%*
			2480	1.881	38.640	1.833	39.162	*2.62%*	*-1.33%*
			2500	1.899	38.611	1.855	39.136	*2.37%*	*-1.34%*
			2510	1.907	38.591	1.866	39.123	*2.20%*	*-1.36%*
			2535	1.927	38.533	1.893	39.092	*1.80%*	*-1.43%*
			2550	1.939	38.495	1.909	39.073	*1.57%*	*-1.48%*
			2560	1.948	38.476	1.920	39.060	*1.46%*	*-1.50%*
			2600	1.982	38.435	1.964	39.009	*0.92%*	*-1.47%*
			2650	2.024	38.331	2.018	38.945	*0.30%*	*-1.58%*
			2680	2.049	38.280	2.051	38.907	*-0.10%*	*-1.61%*
			2700	2.065	38.243	2.073	38.882	*-0.39%*	*-1.64%*
3/28/2023	2450 Head	21.1	2300	1.731	40.820	1.670	39.500	*3.65%*	*3.34%*
			2310	1.740	40.805	1.679	39.480	*3.63%*	*3.36%*
			2320	1.748	40.789	1.687	39.460	*3.62%*	*3.37%*
			2400	1.811	40.666	1.756	39.289	*3.13%*	*3.50%*
			2450	1.852	40.572	1.800	39.200	*2.89%*	*3.50%*
			2480	1.874	40.536	1.833	39.162	*2.24%*	*3.51%*
			2500	1.889	40.505	1.855	39.136	*1.83%*	*3.50%*
			2510	1.896	40.491	1.866	39.123	*1.61%*	*3.50%*
			2535	1.918	40.453	1.893	39.092	*1.32%*	*3.48%*
			2550	1.931	40.427	1.909	39.073	*1.15%*	*3.47%*
			2560	1.940	40.413	1.920	39.060	*1.04%*	*3.46%*
			2600	1.973	40.351	1.964	39.009	*0.46%*	*3.44%*
			2650	2.019	40.251	2.018	38.945	*0.05%*	*3.35%*
			2680	2.041	40.211	2.051	38.907	*-0.49%*	*3.35%*
			2700	2.056	40.181	2.073	38.882	*-0.82%*	*3.34%*

Table 8-2
Measured Head Tissue Properties Cont.

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (˚C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	%dev σ	%dev ε
3/13/2023	5200-5800 Head	20.6	5180	4.651	35.155	4.635	36.009	*0.35%*	*-2.37%*
			5190	4.663	35.138	4.645	35.998	*0.39%*	*-2.39%*
			5200	4.676	35.125	4.655	35.986	*0.45%*	*-2.39%*
			5210	4.686	35.088	4.666	35.975	*0.43%*	*-2.47%*
			5220	4.698	35.056	4.676	35.963	*0.47%*	*-2.52%*
			5240	4.727	35.025	4.696	35.940	*0.66%*	*-2.55%*
			5250	4.738	35.020	4.706	35.929	*0.68%*	*-2.53%*
			5260	4.746	35.002	4.717	35.917	*0.61%*	*-2.55%*
			5270	4.757	34.983	4.727	35.906	*0.63%*	*-2.57%*
			5280	4.765	34.952	4.737	35.894	*0.59%*	*-2.62%*
			5290	4.775	34.922	4.748	35.883	*0.57%*	*-2.68%*
			5300	4.790	34.907	4.758	35.871	*0.67%*	*-2.69%*
			5310	4.802	34.893	4.768	35.860	*0.71%*	*-2.70%*
			5320	4.816	34.875	4.778	35.849	*0.80%*	*-2.72%*
			5500	5.014	34.527	4.963	35.643	*1.03%*	*-3.13%*
			5510	5.028	34.498	4.973	35.632	*1.11%*	*-3.18%*
			5520	5.042	34.471	4.983	35.620	*1.18%*	*-3.23%*
			5530	5.054	34.461	4.994	35.609	*1.20%*	*-3.22%*
			5540	5.067	34.449	5.004	35.597	*1.26%*	*-3.22%*
			5550	5.082	34.426	5.014	35.586	*1.36%*	*-3.26%*
			5560	5.096	34.402	5.024	35.574	*1.43%*	*-3.29%*
			5580	5.111	34.375	5.045	35.551	*1.31%*	*-3.31%*
			5600	5.130	34.324	5.065	35.529	*1.28%*	*-3.39%*
			5610	5.143	34.292	5.076	35.518	*1.32%*	*-3.45%*
			5620	5.160	34.273	5.086	35.506	*1.45%*	*-3.47%*
			5640	5.187	34.252	5.106	35.483	*1.59%*	*-3.47%*
			5660	5.209	34.199	5.127	35.460	*1.60%*	*-3.56%*
			5670	5.222	34.173	5.137	35.449	*1.65%*	*-3.60%*
			5680	5.232	34.155	5.147	35.437	*1.65%*	*-3.62%*
			5690	5.239	34.146	5.158	35.426	*1.57%*	*-3.61%*
			5700	5.249	34.129	5.168	35.414	*1.57%*	*-3.63%*
			5710	5.259	34.104	5.178	35.403	*1.56%*	*-3.67%*
			5720	5.274	34.084	5.188	35.391	*1.66%*	*-3.69%*
			5745	5.309	34.040	5.214	35.363	*1.82%*	*-3.74%*
			5750	5.318	34.031	5.219	35.357	*1.90%*	*-3.75%*
			5755	5.324	34.017	5.224	35.351	*1.91%*	*-3.77%*
			5765	5.335	33.991	5.234	35.340	*1.93%*	*-3.82%*
			5775	5.345	33.975	5.245	35.329	*1.91%*	*-3.83%*
			5785	5.353	33.964	5.255	35.317	*1.86%*	*-3.83%*
			5795	5.364	33.959	5.265	35.305	*1.88%*	*-3.81%*
			5800	5.369	33.950	5.270	35.300	*1.88%*	*-3.82%*
			5800	5.369	33.950	5.270	35.300	*1.88%*	*-3.82%*
			5805	5.373	33.937	5.275	35.294	*1.86%*	*-3.84%*
			5825	5.396	33.884	5.296	35.271	*1.89%*	*-3.93%*
			5835	5.408	33.863	5.305	35.230	*1.94%*	*-3.88%*
			5845	5.421	33.853	5.315	35.210	*1.99%*	*-3.85%*
			5855	5.433	33.840	5.325	35.197	*2.03%*	*-3.86%*
			5865	5.447	33.825	5.336	35.190	*2.08%*	*-3.88%*
			5865	5.447	33.825	5.336	35.190	*2.08%*	*-3.88%*
			5865	5.447	33.825	5.336	35.190	*2.08%*	*-3.88%*
			5865	5.447	33.825	5.336	35.190	*2.08%*	*-3.88%*
			5875	5.463	33.798	5.347	35.183	*2.17%*	*-3.94%*
			5885	5.474	33.772	5.357	35.177	*2.18%*	*-3.99%*
			5905	5.488	33.730	5.379	35.163	*2.03%*	*-4.08%*

Table 8-3
Measured Head Tissue Properties Cont.

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (°C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
4/12/2023	5200-5800 Head	19.5	5180	4.681	36.032	4.635	36.009	0.99%	0.06%
			5190	4.700	36.001	4.645	35.998	1.18%	0.01%
			5200	4.715	35.978	4.655	35.986	1.29%	-0.02%
			5210	4.726	35.950	4.666	35.975	1.29%	-0.07%
			5220	4.737	35.914	4.676	35.963	1.30%	-0.14%
			5240	4.768	35.908	4.696	35.940	1.53%	-0.09%
			5250	4.779	35.907	4.706	35.929	1.55%	-0.06%
			5260	4.787	35.878	4.717	35.917	1.48%	-0.11%
			5270	4.797	35.850	4.727	35.906	1.48%	-0.16%
			5280	4.810	35.827	4.737	35.894	1.54%	-0.19%
			5290	4.821	35.801	4.748	35.883	1.54%	-0.23%
			5300	4.834	35.775	4.758	35.871	1.60%	-0.27%
			5310	4.846	35.745	4.768	35.860	1.64%	-0.32%
			5320	4.857	35.721	4.778	35.849	1.65%	-0.36%
			5500	5.061	35.389	4.963	35.643	1.97%	-0.71%
			5510	5.076	35.351	4.973	35.632	2.07%	-0.79%
			5520	5.094	35.334	4.983	35.620	2.23%	-0.80%
			5530	5.110	35.327	4.994	35.609	2.32%	-0.79%
			5540	5.120	35.317	5.004	35.597	2.32%	-0.79%
			5550	5.132	35.298	5.014	35.586	2.35%	-0.81%
			5560	5.138	35.276	5.024	35.574	2.27%	-0.84%
			5580	5.157	35.247	5.045	35.551	2.22%	-0.86%
			5600	5.184	35.190	5.065	35.529	2.35%	-0.95%
			5610	5.199	35.157	5.076	35.518	2.42%	-1.02%
			5620	5.216	35.125	5.086	35.506	2.56%	-1.07%
			5640	5.247	35.116	5.106	35.483	2.76%	-1.03%
			5660	5.271	35.095	5.127	35.460	2.81%	-1.03%
			5670	5.279	35.071	5.137	35.449	2.76%	-1.07%
			5680	5.287	35.051	5.147	35.437	2.72%	-1.09%
			5690	5.292	35.028	5.158	35.426	2.60%	-1.12%
			5700	5.305	34.998	5.168	35.414	2.65%	-1.17%
			5710	5.319	34.967	5.178	35.403	2.72%	-1.23%
			5720	5.337	34.939	5.188	35.391	2.87%	-1.28%
			5745	5.373	34.912	5.214	35.363	3.05%	-1.28%
			5750	5.380	34.912	5.219	35.357	3.08%	-1.26%
			5755	5.384	34.906	5.224	35.351	3.06%	-1.26%
			5765	5.396	34.888	5.234	35.340	3.10%	-1.28%
			5775	5.406	34.870	5.245	35.329	3.07%	-1.30%
			5785	5.414	34.857	5.255	35.317	3.03%	-1.30%
			5795	5.424	34.830	5.265	35.305	3.02%	-1.35%
			5800	5.429	34.811	5.270	35.300	3.02%	-1.39%
			5800	5.429	34.811	5.270	35.300	3.02%	-1.39%
			5805	5.434	34.798	5.275	35.294	3.01%	-1.41%
			5825	5.466	34.741	5.296	35.271	3.21%	-1.50%
			5835	5.479	34.722	5.305	35.230	3.28%	-1.44%
			5845	5.493	34.719	5.315	35.210	3.35%	-1.39%
			5855	5.504	34.718	5.325	35.197	3.36%	-1.36%
			5865	5.513	34.713	5.336	35.190	3.32%	-1.36%
			5865	5.513	34.713	5.336	35.190	3.32%	-1.36%
			5865	5.513	34.713	5.336	35.190	3.32%	-1.36%
			5865	5.513	34.713	5.336	35.190	3.32%	-1.36%
			5875	5.523	34.690	5.347	35.183	3.29%	-1.40%
			5885	5.533	34.669	5.357	35.177	3.29%	-1.44%
			5905	5.558	34.608	5.379	35.163	3.33%	-1.58%

Note: Per April 2019 TCB Workshop Notes, single head-tissue simulating liquid specified in IEC 62209-1 is permitted to use for all SAR tests. The above measured tissue parameters were used in the cDASY6 software. The cDASY6 software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB Publication 865664 D01v01r04 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

8.2 Test System Verification

Prior to SAR assessment, the system is verified to ±10% of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in SAR System Validation Appendix.

Table 8-4
System Verification Results – 1g

System Verification TARGET & MEASURED												
SAR System	Tissue Frequency (MHz)	Tissue Type	Date	Amb. Temp. (C)	Liquid Temp. (C)	Input Power (W)	Source SN	Probe SN	Measured SAR1g (W/kg)	1W Target SAR1g (W/kg)	1W Normalized SAR 1g (W/kg)	Deviation1g (%)
AM9	2450	HEAD	03/01/2023	22.2	19.5	0.10	921	7427	5.170	54.20	51.700	-4.61%
AM9	2450	HEAD	03/28/2023	22.2	21.2	0.10	750	7427	5.540	52.60	55.400	5.32%
AM9	5250	HEAD	03/13/2023	21.5	20.2	0.05	1163	7427	4.050	80.20	81.000	1.00%
AM9	5600	HEAD	03/13/2023	21.5	20.2	0.05	1163	7427	4.030	83.30	80.600	-3.24%
AM9	5750	HEAD	03/13/2023	21.5	20.2	0.05	1163	7427	4.190	81.00	83.800	3.46%

Table 8-3
System Verification Results – 10g

System Verification TARGET & MEASURED												
SAR System	Tissue Frequency (MHz)	Tissue Type	Date	Amb. Temp. (C)	Liquid Temp. (C)	Input Power (W)	Source SN	Probe SN	Measured SAR10g (W/kg)	1W Target SAR10g (W/kg)	1W Normalized SAR10g (W/kg)	Deviation10g (%)
AM11	2450	HEAD	02/28/2023	22.3	19.6	0.10	750	3949	2.580	24.50	25.800	5.31%
AM11	2450	HEAD	03/02/2023	19.0	19.0	0.10	750	3949	2.570	24.50	25.700	4.90%
AM11	5250	HEAD	04/12/2023	23.9	19.7	0.05	1066	7308	1.120	23.10	22.400	-3.03%
AM11	5600	HEAD	04/12/2023	23.9	19.7	0.05	1066	7308	1.180	24.10	23.600	-2.07%
AM11	5750	HEAD	04/12/2023	23.9	19.7	0.05	1066	7308	1.160	22.60	23.200	2.65%

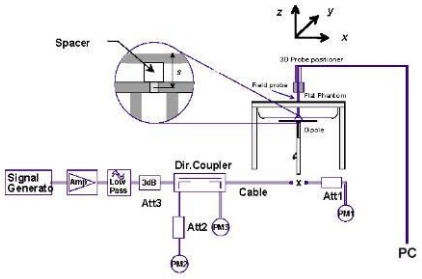


Figure 8-1
System Verification Setup Diagram

Figure 8-2
System Verification Setup Photo

9 SAR DATA SUMMARY

9.1 Standalone Head SAR Data

Table 9-1
2.4 GHz WLAN Antenna 1 Head SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.														(W/kg)			(W/kg)	
2417	2	802.11b	DSSS	21.50	20.48	0.05	0 mm	Ant 1	V1	YWQ4M6TVH0	1	N/A	Face-Down	99.7	0.032	1.265	1.003	0.041	
2437	6	802.11b	DSSS	21.50	20.55	-0.08	0 mm	Ant 1	V1	YWQ4M6TVH0	1	N/A	Face-Down	99.7	0.040	1.245	1.003	0.050	
2462	11	802.11b	DSSS	21.50	20.57	-0.08	0 mm	Ant 1	V1	YWQ4M6TVH0	1	N/A	Face-Down	99.7	0.043	1.239	1.003	0.053	
2462	11	802.11b	DSSS	21.50	20.43	-0.13	0 mm	Ant 1	V2	LV9GDP4QDX	1	N/A	Face-Down	99.7	0.026	1.279	1.003	0.033	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram									

Table 9-2
2.4 GHz WLAN Antenna 2 Head SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.														(W/kg)			(W/kg)	
2417	2	802.11b	DSSS	21.50	20.46	0.03	0 mm	Ant 2	V1	YWQ4M6TVH0	1	N/A	Face-Down	99.7	0.056	1.271	1.003	0.071	
2437	6	802.11b	DSSS	21.50	20.50	0.04	0 mm	Ant 2	V1	YWQ4M6TVH0	1	N/A	Face-Down	99.7	0.062	1.259	1.003	0.078	
2462	11	802.11b	DSSS	21.50	20.55	-0.02	0 mm	Ant 2	V1	YWQ4M6TVH0	1	N/A	Face-Down	99.7	0.071	1.245	1.003	0.089	A1
2462	11	802.11b	DSSS	21.50	20.53	-0.02	0 mm	Ant 2	V2	LV9GDP4QDX	1	N/A	Face-Down	99.7	0.050	1.250	1.003	0.063	
2462	11	802.11b	DSSS	21.50	20.55	-0.07	0 mm	Ant 2	V1	YWQ4M6TVH0	1	Main Light-Seal	Face-Down	99.7	0.033	1.245	1.003	0.041	
2462	11	802.11b	DSSS	21.50	20.55	0.04	0 mm	Ant 2	V1	YWQ4M6TVH0	1	Mini Light-Seal	Face-Down	99.7	0.025	1.245	1.003	0.031	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram									

Table 9-3
5 GHz WLAN Antenna 1 Head SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)			(W/kg)	
5270	54	802.11n	OFDM	40	18.50	17.54	0.07	0 mm	Ant 1	V1	KHYGHF6L25	13.5	N/A	Face-Down	97.7	0.014	1.247	1.024	0.018	
5270	54	802.11n	OFDM	40	18.50	17.58	-0.09	0 mm	Ant 1	V2	LV9GDP4QDX	13.5	N/A	Face-Down	97.7	0.005	1.236	1.024	0.006	
5270	54	802.11n	OFDM	40	18.50	17.54	-0.12	0 mm	Ant 1	V1	KHYGHF6L25	13.5	Main Light-Seal	Face-Down	97.7	0.008	1.247	1.024	0.010	
5270	54	802.11n	OFDM	40	18.50	17.54	-0.05	0 mm	Ant 1	V1	KHYGHF6L25	13.5	Mini Light-Seal	Face-Down	97.7	0.007	1.247	1.024	0.009	
5530	106	802.11ac	OFDM	80	16.50	15.45	0.11	0 mm	Ant 1	V2	LV9GDP4QDX	29.3	N/A	Face-Down	95.8	0.019	1.274	1.044	0.025	
5610	122	802.11ac	OFDM	80	18.75	17.02	-0.03	0 mm	Ant 1	V2	LV9GDP4QDX	29.3	N/A	Face-Down	95.8	0.036	1.489	1.044	0.056	
5690	138	802.11ac	OFDM	80	18.75	17.06	-0.02	0 mm	Ant 1	V1	M99429MXDC	29.3	N/A	Face-Down	95.8	0.030	1.476	1.044	0.046	
5690	138	802.11ac	OFDM	80	18.75	16.92	0.01	0 mm	Ant 1	V2	LV9GDP4QDX	29.3	N/A	Face-Down	95.8	0.038	1.524	1.044	0.060	
5690	138	802.11ac	OFDM	80	18.75	16.92	0.00	0 mm	Ant 1	V2	LV9GDP4QDX	29.3	Main Light-Seal	Face-Down	95.8	0.023	1.524	1.044	0.037	
5690	138	802.11ac	OFDM	80	18.75	16.92	-0.10	0 mm	Ant 1	V2	LV9GDP4QDX	29.3	Mini Light-Seal	Face-Down	95.8	0.016	1.524	1.044	0.025	
5755	151	802.11n	OFDM	40	19.25	18.03	-0.09	0 mm	Ant 1	V1	YWQ4M6TVH0	13.5	N/A	Face-Down	97.7	0.069	1.324	1.024	0.094	
5795	159	802.11n	OFDM	40	19.25	18.02	-0.04	0 mm	Ant 1	V1	YWQ4M6TVH0	13.5	N/A	Face-Down	97.7	0.073	1.327	1.024	0.099	A2
5795	159	802.11n	OFDM	40	19.25	18.05	0.04	0 mm	Ant 1	V2	LV9GDP4QDX	13.5	N/A	Face-Down	97.7	0.071	1.318	1.024	0.096	
5795	159	802.11n	OFDM	40	19.25	18.02	-0.15	0 mm	Ant 1	V1	YWQ4M6TVH0	13.5	Main Light-Seal	Face-Down	97.7	0.039	1.327	1.024	0.053	
5795	159	802.11n	OFDM	40	19.25	18.02	-0.10	0 mm	Ant 1	V1	YWQ4M6TVH0	13.5	Mini Light-Seal	Face-Down	97.7	0.036	1.327	1.024	0.049	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6W/kg (mW/g) averaged over 1 gram									

Table 9-4
5 GHz WLAN Antenna 2 Head SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Side	Duty Cycle (%)	SAR (1g) (W/kg)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g) (W/kg)	Plot #
MHz	Ch.																			
5270	46	802.11n	OFDM	40	18.00	17.75	-0.04	0 mm	Ant 2	V1	M99429MXDC	13.5	N/A	Face-Down	97.7	0.028	1.059	1.024	0.030	
5270	46	802.11n	OFDM	40	18.00	17.66	-0.07	0 mm	Ant 2	V2	LV9GDP4QDX	13.5	N/A	Face-Down	97.7	0.018	1.081	1.024	0.020	
5270	138	802.11ac	OFDM	80	18.25	16.49	0.03	0 mm	Ant 2	V1	M99429MXDC	29.3	N/A	Face-Down	95.8	0.022	1.500	1.044	0.034	
5270	138	802.11ac	OFDM	80	18.25	16.48	0.04	0 mm	Ant 2	V2	LV9GDP4QDX	29.3	N/A	Face-Down	95.8	0.017	1.503	1.044	0.027	
5795	159	802.11n	OFDM	40	18.75	18.01	0.07	0 mm	Ant 2	V1	YWQ4M6TVH0	13.5	N/A	Face-Down	97.7	0.050	1.186	1.024	0.059	
5795	159	802.11n	OFDM	40	18.75	18.00	0.04	0 mm	Ant 2	V2	LV9GDP4QDX	13.5	N/A	Face-Down	97.7	0.039	1.189	1.024	0.046	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6W/kg (mW/g) averaged over 1 gram												

Table 9-5
Bluetooth Antenna 1 Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Side	Duty Cycle (%)	SAR (1g) (W/kg)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g) (W/kg)	Plot #
MHz	Ch.																		
2402	0	Bluetooth	FHSS	20.00	18.61	0.14	0 mm	Ant 1	V1	YWQ4M6TVH0	1	N/A	Face-Down	77.1	0.034	1.377	1.005	0.047	
2402	0	Bluetooth	FHSS	20.00	18.65	-0.09	0 mm	Ant 1	V2	LV9GDP4QDX	1	N/A	Face-Down	77.1	0.029	1.365	1.005	0.040	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram											

Note: The reported SAR was scaled to the 77.5% transmission duty factor to determine compliance since the duty factor of the device is permanently limited to 77.5% per the manufacturer.

Table 9-6
Bluetooth Antenna 2 Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Side	Duty Cycle (%)	SAR (1g) (W/kg)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g) (W/kg)	Plot #
MHz	Ch.																		
2402	0	Bluetooth	FHSS	20.00	18.64	0.03	0 mm	Ant 2	V1	YWQ4M6TVH0	1	N/A	Face-Down	77.1	0.030	1.368	1.005	0.041	
2402	0	Bluetooth	FHSS	20.00	18.65	-0.02	0 mm	Ant 2	V2	LV9GDP4QDX	1	N/A	Face-Down	77.1	0.046	1.365	1.005	0.063	A3
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram											

Note: The reported SAR was scaled to the 77.5% transmission duty factor to determine compliance since the duty factor of the device is permanently limited to 77.5% per the manufacturer.

Table 9-7
Bluetooth Antenna NB UNII_L Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Side	Duty Cycle (%)	SAR (1g) (W/kg)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g) (W/kg)	Plot #
MHz	Ch.																		
2441	39	Bluetooth	FHSS	10.50	10.50	-0.03	0 mm	Ant NB UNII_L (2.4GHz)	V1	KHYGHF6L25	1	N/A	Face-Down	76.9	0.005	1.000	1.008	0.005	
2441	39	Bluetooth	FHSS	10.50	10.35	0.00	0 mm	Ant NB UNII_L (2.4GHz)	V2	J9X0YHWQPH	1	N/A	Face-Down	76.9	0.003	1.035	1.008	0.003	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram											

Note: The reported SAR was scaled to the 77.5% transmission duty factor to determine compliance since the duty factor of the device is permanently limited to 77.5% per the manufacturer.

Table 9-8
NB UNII Antenna NB UNII_R Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.														(W/kg)			(W/kg)	
5201	Mid	NB UNII 1	FHSS	5.50	4.71	0.19	0 mm	Ant NB UNII_R (5GHz)	V1	M99429MXDC	1	N/A	Face-Down	100	0.024	1.199	1.000	0.029	
5201	Mid	NB UNII 1	FHSS	5.50	4.52	0.00	0 mm	Ant NB UNII_R (5GHz)	V2	LV9GDP4QDX	1	N/A	Face-Down	100	0.024	1.253	1.000	0.030	
5788	Mid	NB UNII 3	FHSS	5.50	4.54	-0.08	0 mm	Ant NB UNII_R (5GHz)	V1	M99429MXDC	1	N/A	Face-Down	100	0.026	1.247	1.000	0.032	
5788	Mid	NB UNII 3	FHSS	5.50	4.74	-0.19	0 mm	Ant NB UNII_R (5GHz)	V2	LV9GDP4QDX	1	N/A	Face-Down	100	0.028	1.191	1.000	0.033	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram											

Table 9-9
NB UNII Antenna NB UNII_L Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Side	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.														(W/kg)			(W/kg)	
5201	Mid	NB UNII 1	FHSS	5.50	4.77	-0.13	0 mm	Ant NB UNII_L (5GHz)	V1	M99429MXDC	1	N/A	Face-Down	100	0.028	1.183	1.000	0.033	
5201	Mid	NB UNII 1	FHSS	5.50	4.71	-0.06	0 mm	Ant NB UNII_L (5GHz)	V2	LV9GDP4QDX	1	N/A	Face-Down	100	0.025	1.199	1.000	0.030	
5201	Mid	NB UNII 1	FHSS	5.50	4.77	0.10	0 mm	Ant NB UNII_L (5GHz)	V2	LV9GDP4QDX	1	Main Light-Seal	Face-Down	100	0.022	1.183	1.000	0.026	
5201	Mid	NB UNII 1	FHSS	5.50	4.77	-0.21	0 mm	Ant NB UNII_L (5GHz)	V2	LV9GDP4QDX	1	Mini Light-Seal	Face-Down	100	0.025	1.183	1.000	0.030	
5731	Low	NB UNII 3	FHSS	5.50	4.55	-0.09	0 mm	Ant NB UNII_L (5GHz)	V1	M99429MXDC	1	N/A	Face-Down	100	0.029	1.245	1.000	0.036	
5731	Low	NB UNII 3	FHSS	5.50	4.69	0.00	0 mm	Ant NB UNII_L (5GHz)	V2	LV9GDP4QDX	1	N/A	Face-Down	100	0.030	1.205	1.000	0.036	A4
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram											

9.2 Standalone Extremity SAR Data

Table 9-10
2.4 GHz WLAN Antenna 1 Extremity SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Point Scheme	Duty Cycle (%)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.																	(W/kg)	(W/kg)	
2417	2	802.11b	DSSS	22	21.50	20.48	0.01	0 mm	Ant 1	V1	YWQ4M6TVH0	1	N/A	8	99.7	1.265	1.003	2.150	2.728	
2417	2	802.11b	DSSS	22	21.50	20.48	-0.07	0 mm	Ant 1	V1	YWQ4M6TVH0	1	N/A	9	99.7	1.265	1.003	2.250	2.855	A5
2417	2	802.11b	DSSS	22	21.50	20.50	-0.01	0 mm	Ant 1	V2	J9X0YHWQPH	1	N/A	9	99.7	1.259	1.003	2.180	2.753	
2417	2	802.11b	DSSS	22	21.50	20.48	0.13	0 mm	Ant 1	V1	YWQ4M6TVH0	1	Main Light-Seal	9	99.7	1.265	1.003	2.140	2.715	
2417	2	802.11b	DSSS	22	21.50	20.48	-0.02	0 mm	Ant 1	V1	YWQ4M6TVH0	1	Mini Light-Seal	9	99.7	1.265	1.003	2.220	2.817	
2417	2	802.11b	DSSS	22	21.50	20.48	0.01	0 mm	Ant 1	V1	YWQ4M6TVH0	1	N/A	10	99.7	1.265	1.003	2.030	2.576	
2417	2	802.11b	DSSS	22	21.50	20.48	0.00	0 mm	Ant 1	V1	YWQ4M6TVH0	1	N/A	32	99.7	1.265	1.003	1.290	1.637	
2437	6	802.11b	DSSS	22	21.50	20.64	0.07	0 mm	Ant 1	V2	J9X0YHWQPH	1	N/A	9	99.7	1.219	1.003	1.970	2.409	
2462	11	802.11b	DSSS	22	21.50	20.43	0.00	0 mm	Ant 1	V2	J9X0YHWQPH	1	N/A	9	99.7	1.279	1.003	1.760	2.258	
2417	2	802.11b	DSSS	22	21.50	20.48	-0.02	0 mm	Ant 1	V1	YWQ4M6TVH0	1	N/A	9	99.7	1.265	1.003	2.250	2.855	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population														Extremity 4.0 W/kg (mW/g) averaged over 10 gram						

Note: Blue entry represents variability measurement.

Table 9-11
2.4 GHz WLAN Antenna 2 Extremity SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Point Scheme	Duty Cycle (%)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.																	(W/kg)	(W/kg)	
2417	2	802.11b	DSSS	22	21.50	20.46	0.00	0 mm	Ant 2	V1	YWQ4M6TVH0	1	N/A	2	99.7	1.271	1.003	1.830	2.333	
2437	6	802.11b	DSSS	22	21.50	20.50	-0.01	0 mm	Ant 2	V1	YWQ4M6TVH0	1	N/A	2	99.7	1.259	1.003	1.830	2.311	
2462	11	802.11b	DSSS	22	21.50	20.53	0.00	0 mm	Ant 2	V2	J9X0YHWQPH	1	N/A	1	99.7	1.250	1.003	2.000	2.508	
2462	11	802.11b	DSSS	22	21.50	20.55	0.01	0 mm	Ant 2	V1	YWQ4M6TVH0	1	N/A	2	99.7	1.245	1.003	2.040	2.547	
2462	11	802.11b	DSSS	22	21.50	20.53	0.00	0 mm	Ant 2	V2	J9X0YHWQPH	1	N/A	2	99.7	1.250	1.003	2.120	2.658	
2462	11	802.11b	DSSS	22	21.50	20.53	0.02	0 mm	Ant 2	V2	J9X0YHWQPH	1	N/A	3	99.7	1.250	1.003	2.100	2.633	
2462	11	802.11b	DSSS	22	21.50	20.53	-0.06	0 mm	Ant 2	V2	J9X0YHWQPH	1	N/A	10	99.7	1.250	1.003	1.340	1.680	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population													Extremity 4.0 W/kg (mW/g) averaged over 10 gram							

Table 9-12
5 GHz WLAN Antenna 1 Extremity SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Point Scheme	Duty Cycle (%)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.																	(W/kg)	(W/kg)	
5270	54	802.11n	OFDM	40	18.50	17.54	0.01	0 mm	Ant 1	V1	M99429MXDC	13.5	N/A	11	97.7	1.247	1.024	2.100	2.682	
5270	54	802.11n	OFDM	40	18.50	17.54	0.00	0 mm	Ant 1	V1	M99429MXDC	13.5	N/A	12	97.7	1.247	1.024	2.250	2.873	
5270	54	802.11n	OFDM	40	18.50	17.58	-0.01	0 mm	Ant 1	V2	J9X0YHWQPH	13.5	N/A	12	97.7	1.236	1.024	1.880	2.379	
5270	54	802.11n	OFDM	40	18.50	17.54	0.03	0 mm	Ant 1	V1	M99429MXDC	13.5	N/A	13	97.7	1.247	1.024	2.080	2.656	
5270	54	802.11n	OFDM	40	18.50	17.54	-0.07	0 mm	Ant 1	V1	M99429MXDC	13.5	N/A	14	97.7	1.247	1.024	2.170	2.771	
5270	54	802.11n	OFDM	40	18.50	17.54	0.00	0 mm	Ant 1	V1	M99429MXDC	13.5	Main Light-Seal	12	97.7	1.247	1.024	2.250	2.873	
5270	54	802.11n	OFDM	40	18.50	17.54	0.01	0 mm	Ant 1	V1	M99429MXDC	13.5	Mini Light-Seal	12	97.7	1.247	1.024	2.230	2.848	
5270	54	802.11n	OFDM	40	18.50	17.54	-0.01	0 mm	Ant 1	V1	M99429MXDC	13.5	N/A	33	97.7	1.247	1.024	2.070	2.643	
5270	54	802.11n	OFDM	40	18.50	17.54	-0.01	0 mm	Ant 1	V1	M99429MXDC	13.5	N/A	34	97.7	1.247	1.024	1.880	2.401	
5270	54	802.11n	OFDM	40	18.50	17.54	0.02	0 mm	Ant 1	V1	M99429MXDC	13.5	N/A	39	97.7	1.247	1.024	1.930	2.464	
5310	62	802.11n	OFDM	40	17.25	16.21	0.05	0 mm	Ant 1	V1	M99429MXDC	13.5	N/A	12	97.7	1.271	1.024	1.720	2.239	
5530	106	802.11ac	OFDM	80	16.50	15.51	-0.03	0 mm	Ant 1	V1	YWQ4M6TVH0	29.3	N/A	12	95.8	1.256	1.044	1.440	1.888	
5610	122	802.11ac	OFDM	80	18.75	17.04	-0.02	0 mm	Ant 1	V1	YWQ4M6TVH0	29.3	N/A	11	95.8	1.483	1.044	1.670	2.586	
5610	122	802.11ac	OFDM	80	18.75	17.04	0.00	0 mm	Ant 1	V1	YWQ4M6TVH0	29.3	N/A	12	95.8	1.483	1.044	1.890	2.926	
5610	122	802.11ac	OFDM	80	18.75	17.02	-0.05	0 mm	Ant 1	V2	J9X0YHWQPH	29.3	N/A	12	95.8	1.489	1.044	1.660	2.580	
5610	122	802.11ac	OFDM	80	18.75	17.04	-0.01	0 mm	Ant 1	V1	YWQ4M6TVH0	29.3	Main Light-Seal	12	95.8	1.483	1.044	1.880	2.911	
5610	122	802.11ac	OFDM	80	18.75	17.04	-0.05	0 mm	Ant 1	V1	YWQ4M6TVH0	29.3	Mini Light-Seal	12	95.8	1.483	1.044	1.800	2.787	
5610	122	802.11ac	OFDM	80	18.75	17.04	0.02	0 mm	Ant 1	V1	YWQ4M6TVH0	29.3	N/A	13	95.8	1.483	1.044	1.650	2.555	
5610	122	802.11ac	OFDM	80	18.75	17.04	0.00	0 mm	Ant 1	V1	YWQ4M6TVH0	29.3	N/A	14	95.8	1.483	1.044	1.700	2.632	
5610	122	802.11ac	OFDM	80	18.75	17.04	-0.05	0 mm	Ant 1	V1	YWQ4M6TVH0	29.3	N/A	33	95.8	1.483	1.044	1.700	2.632	
5610	122	802.11ac	OFDM	80	18.75	17.04	0.00	0 mm	Ant 1	V1	YWQ4M6TVH0	29.3	N/A	34	95.8	1.483	1.044	1.500	2.322	
5610	122	802.11ac	OFDM	80	18.75	17.04	0.00	0 mm	Ant 1	V1	YWQ4M6TVH0	29.3	N/A	39	95.8	1.483	1.044	1.590	2.462	
5690	138	802.11ac	OFDM	80	18.75	17.06	0.02	0 mm	Ant 1	V1	YWQ4M6TVH0	29.3	N/A	12	95.8	1.476	1.044	1.500	2.311	
5755	151	802.11n	OFDM	40	19.25	18.03	0.01	0 mm	Ant 1	V1	YWQ4M6TVH0	13.5	N/A	11	97.7	1.324	1.024	2.040	2.766	
5795	159	802.11n	OFDM	40	19.25	18.02	-0.02	0 mm	Ant 1	V1	YWQ4M6TVH0	13.5	N/A	11	97.7	1.327	1.024	2.160	2.935	
5795	159	802.11n	OFDM	40	19.25	18.05	0.03	0 mm	Ant 1	V2	YV4PVHN41T	13.5	N/A	11	97.7	1.318	1.024	2.050	2.767	
5795	159	802.11n	OFDM	40	19.25	18.02	0.01	0 mm	Ant 1	V1	YWQ4M6TVH0	13.5	N/A	12	97.7	1.327	1.024	1.990	2.704	
5795	159	802.11n	OFDM	40	19.25	18.02	-0.02	0 mm	Ant 1	V1	YWQ4M6TVH0	13.5	N/A	13	97.7	1.327	1.024	2.090	2.840	
5795	159	802.11n	OFDM	40	19.25	18.02	-0.02	0 mm	Ant 1	V1	YWQ4M6TVH0	13.5	N/A	14	97.7	1.327	1.024	1.980	2.691	
5795	159	802.11n	OFDM	40	19.25	18.02	-0.07	0 mm	Ant 1	V1	YWQ4M6TVH0	13.5	N/A	31	97.7	1.327	1.024	1.790	2.432	
5795	159	802.11n	OFDM	40	19.25	18.02	0.00	0 mm	Ant 1	V1	YWQ4M6TVH0	13.5	N/A	32	97.7	1.327	1.024	1.910	2.595	
5795	159	802.11n	OFDM	40	19.25	18.02	0.01	0 mm	Ant 1	V1	YWQ4M6TVH0	13.5	N/A	36	97.7	1.327	1.024	1.840	2.500	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population													Extremity 4.0 W/kg (mW/g) averaged over 10 gram							

Table 9-13
5 GHz WLAN Antenna 2 Extremity SAR

MEASUREMENT RESULTS																				
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Point Scheme	Duty Cycle (%)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.																	(W/kg)	(W/kg)	
5190	38	802.11n	OFDM	40	15.25	14.40	-0.01	0 mm	Ant 2	V2	M99429MXDC	13.5	N/A	6	97.7	1.216	1.024	0.963	1.199	
5230	46	802.11n	OFDM	40	18.00	17.66	-0.01	0 mm	Ant 2	V2	M99429MXDC	13.5	N/A	4	97.7	1.081	1.024	2.530	2.801	
5230	46	802.11n	OFDM	40	18.00	17.66	0.02	0 mm	Ant 2	V2	M99429MXDC	13.5	N/A	5	97.7	1.081	1.024	2.590	2.867	
5230	46	802.11n	OFDM	40	18.00	17.66	0.13	0 mm	Ant 2	V1	YWQ4M6TVH0	13.5	N/A	6	97.7	1.081	1.024	2.560	2.834	
5230	46	802.11n	OFDM	40	18.00	17.66	-0.01	0 mm	Ant 2	V2	M99429MXDC	13.5	N/A	6	97.7	1.081	1.024	2.660	2.944	A6
5230	46	802.11n	OFDM	40	18.00	17.66	0.00	0 mm	Ant 2	V2	M99429MXDC	13.5	Main Light-Seal	6	97.7	1.081	1.024	2.630	2.911	
5230	46	802.11n	OFDM	40	18.00	17.66	-0.01	0 mm	Ant 2	V2	M99429MXDC	13.5	Mini Light-Seal	6	97.7	1.081	1.024	2.630	2.911	
5230	46	802.11n	OFDM	40	18.00	17.66	-0.01	0 mm	Ant 2	V2	M99429MXDC	13.5	N/A	7	97.7	1.081	1.024	2.500	2.767	
5230	46	802.11n	OFDM	40	18.00	17.66	-0.03	0 mm	Ant 2	V2	M99429MXDC	13.5	N/A	14	97.7	1.081	1.024	2.230	2.468	
5230	46	802.11n	OFDM	40	18.00	17.66	-0.01	0 mm	Ant 2	V2	M99429MXDC	13.5	N/A	20	97.7	1.081	1.024	1.940	2.147	
5230	46	802.11n	OFDM	40	18.00	17.66	0.03	0 mm	Ant 2	V2	M99429MXDC	13.5	N/A	21	97.7	1.081	1.024	2.160	2.391	
5530	106	802.11ac	OFDM	80	16.50	15.46	0.03	0 mm	Ant 2	V1	YWQ4M6TVH0	29.3	N/A	5	95.8	1.271	1.044	1.300	1.725	
5610	122	802.11ac	OFDM	80	18.25	16.46	-0.02	0 mm	Ant 2	V1	YWQ4M6TVH0	29.3	N/A	4	95.8	1.510	1.044	1.540	2.428	
5610	122	802.11ac	OFDM	80	18.25	16.46	-0.01	0 mm	Ant 2	V1	YWQ4M6TVH0	29.3	N/A	5	95.8	1.510	1.044	1.630	2.570	
5610	122	802.11ac	OFDM	80	18.25	16.44	-0.04	0 mm	Ant 2	V2	J9XDYHWQPH	29.3	N/A	5	95.8	1.517	1.044	1.620	2.566	
5610	122	802.11ac	OFDM	80	18.25	16.46	0.02	0 mm	Ant 2	V1	YWQ4M6TVH0	29.3	N/A	6	95.8	1.510	1.044	1.510	2.380	
5610	122	802.11ac	OFDM	80	18.25	16.46	0.05	0 mm	Ant 2	V1	YWQ4M6TVH0	29.3	N/A	7	95.8	1.510	1.044	1.630	2.570	
5610	122	802.11ac	OFDM	80	18.25	16.46	-0.03	0 mm	Ant 2	V1	YWQ4M6TVH0	29.3	N/A	10	95.8	1.510	1.044	1.610	2.538	
5610	122	802.11ac	OFDM	80	18.25	16.46	0.04	0 mm	Ant 2	V1	YWQ4M6TVH0	29.3	N/A	11	95.8	1.510	1.044	1.490	2.349	
5610	122	802.11ac	OFDM	80	18.25	16.46	-0.01	0 mm	Ant 2	V1	YWQ4M6TVH0	29.3	N/A	17	95.8	1.510	1.044	1.470	2.317	
5690	138	802.11ac	OFDM	80	18.25	16.49	0.01	0 mm	Ant 2	V1	YWQ4M6TVH0	29.3	N/A	5	95.8	1.500	1.044	1.350	2.114	
5755	151	802.11n	OFDM	40	18.75	17.99	-0.01	0 mm	Ant 2	V2	YV4PVHN41T	13.5	N/A	4	97.7	1.191	1.024	2.180	2.659	
5755	151	802.11n	OFDM	40	18.75	17.98	0.02	0 mm	Ant 2	V1	YWQ4M6TVH0	13.5	N/A	5	97.7	1.194	1.024	2.250	2.751	
5755	151	802.11n	OFDM	40	18.75	17.99	-0.14	0 mm	Ant 2	V2	YV4PVHN41T	13.5	N/A	5	97.7	1.191	1.024	2.430	2.964	
5755	151	802.11n	OFDM	40	18.75	17.99	-0.01	0 mm	Ant 2	V2	YV4PVHN41T	13.5	Main Light-Seal	5	97.7	1.191	1.024	2.200	2.683	
5755	151	802.11n	OFDM	40	18.75	17.99	0.03	0 mm	Ant 2	V2	YV4PVHN41T	13.5	Mini Light-Seal	5	97.7	1.191	1.024	2.180	2.659	
5755	151	802.11n	OFDM	40	18.75	17.99	-0.04	0 mm	Ant 2	V2	YV4PVHN41T	13.5	N/A	6	97.7	1.191	1.024	2.210	2.695	
5755	151	802.11n	OFDM	40	18.75	17.99	0.03	0 mm	Ant 2	V2	YV4PVHN41T	13.5	N/A	7	97.7	1.191	1.024	2.360	2.878	
5755	151	802.11n	OFDM	40	18.75	17.99	-0.04	0 mm	Ant 2	V2	YV4PVHN41T	13.5	N/A	10	97.7	1.191	1.024	2.130	2.598	
5755	151	802.11n	OFDM	40	18.75	17.99	-0.04	0 mm	Ant 2	V2	YV4PVHN41T	13.5	N/A	11	97.7	1.191	1.024	2.060	2.512	
5755	151	802.11n	OFDM	40	18.75	17.99	-0.02	0 mm	Ant 2	V2	YV4PVHN41T	13.5	N/A	17	97.7	1.191	1.024	2.060	2.512	
5755	159	802.11n	OFDM	40	18.75	18.00	-0.13	0 mm	Ant 2	V2	YV4PVHN41T	13.5	N/A	5	97.7	1.189	1.024	1.910	2.325	
5755	46	802.11n	OFDM	40	18.00	17.66	0.06	0 mm	Ant 2	V2	M99429MXDC	13.5	N/A	6	97.7	1.081	1.024	2.570	2.845	
5755	151	802.11n	OFDM	40	18.75	17.99	-0.03	0 mm	Ant 2	V2	YV4PVHN41T	13.5	N/A	5	97.7	1.191	1.024	2.200	2.683	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population													Extremity 4.0 W/kg (mW/g) averaged over 10 gram							

Note: Blue entry represents variability measurement.

Table 9-14
Bluetooth Antenna 1 Extremity SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Point Scheme	Duty Cycle (%)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.																(W/kg)	(W/kg)	
2402	0	Bluetooth	FHSS	20.00	18.61	-0.02	0 mm	Ant 1	V1	KHYGHF6L25	1	N/A	8	77.1	1.377	1.005	1.390	1.924	
2402	0	Bluetooth	FHSS	20.00	18.65	0.02	0 mm	Ant 1	V2	YV4PVHN41T	1	N/A	8	77.1	1.365	1.005	1.590	2.181	A7
2402	0	Bluetooth	FHSS	20.00	18.65	-0.02	0 mm	Ant 1	V2	YV4PVHN41T	1	N/A	9	77.1	1.365	1.005	1.520	2.085	
2402	0	Bluetooth	FHSS	20.00	18.65	0.10	0 mm	Ant 1	V2	YV4PVHN41T	1	N/A	10	77.1	1.365	1.005	1.360	1.866	
2402	0	Bluetooth	FHSS	20.00	18.65	0.01	0 mm	Ant 1	V2	YV4PVHN41T	1	N/A	25	77.1	1.365	1.005	1.430	1.962	
2402	0	Bluetooth	FHSS	20.00	18.65	0.00	0 mm	Ant 1	V2	YV4PVHN41T	1	N/A	30	77.1	1.365	1.005	0.951	1.305	
2402	0	Bluetooth	FHSS	20.00	18.65	0.01	0 mm	Ant 1	V2	YV4PVHN41T	1	N/A	31	77.1	1.365	1.005	0.915	1.255	
2441	39	Bluetooth	FHSS	20.00	18.60	0.00	0 mm	Ant 1	V2	YV4PVHN41T	1	N/A	8	77.1	1.380	1.005	1.360	1.886	
2480	78	Bluetooth	FHSS	20.00	18.44	0.01	0 mm	Ant 1	V2	YV4PVHN41T	1	N/A	8	77.1	1.432	1.005	1.080	1.554	
2402	0	Bluetooth	FHSS	18.00	17.21	-0.01	0 mm	Ant 1	V2	YV4PVHN41T	1	N/A	8	77.1	1.199	1.005	0.756	0.911	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population													Extremity 4.0 W/Kg (mW/g) averaged over 10 grams						

Note: The reported SAR was scaled to the 77.5% transmission duty factor to determine compliance since the duty factor of the device is permanently limited to 77.5% per the manufacturer.

Table 9-15
Bluetooth Antenna 2 Extremity SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Point Scheme	Duty Cycle (%)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.																(W/kg)	(W/kg)	
2402	0	Bluetooth	FHSS	20.00	18.64	-0.14	0 mm	Ant 2	V1	KHYGHF6L25	1	N/A	2	77.1	1.368	1.005	1.280	1.760	
2441	39	Bluetooth	FHSS	20.00	18.60	-0.02	0 mm	Ant 2	V1	KHYGHF6L25	1	N/A	2	77.1	1.380	1.005	1.290	1.789	
2480	78	Bluetooth	FHSS	20.00	18.62	0.04	0 mm	Ant 2	V1	KHYGHF6L25	1	N/A	1	77.1	1.374	1.005	1.330	1.837	
2480	78	Bluetooth	FHSS	20.00	18.62	-0.10	0 mm	Ant 2	V1	KHYGHF6L25	1	N/A	2	77.1	1.374	1.005	1.430	1.975	
2480	78	Bluetooth	FHSS	20.00	18.63	0.01	0 mm	Ant 2	V2	YV4PVHN41T	1	N/A	2	77.1	1.371	1.005	1.550	2.136	
2480	78	Bluetooth	FHSS	20.00	18.62	-0.01	0 mm	Ant 2	V1	KHYGHF6L25	1	N/A	3	77.1	1.374	1.005	1.390	1.919	
2480	78	Bluetooth	FHSS	20.00	18.62	-0.05	0 mm	Ant 2	V1	KHYGHF6L25	1	N/A	10	77.1	1.374	1.005	0.812	1.121	
2480	78	Bluetooth	FHSS	18.00	17.13	0.02	0 mm	Ant 2	V2	YV4PVHN41T	1	N/A	2	77.1	1.222	1.005	0.683	0.839	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population													Extremity 4.0 W/Kg (mW/g) averaged over 10 grams						

Note: The reported SAR was scaled to the 77.5% transmission duty factor to determine compliance since the duty factor of the device is permanently limited to 77.5% per the manufacturer.

Table 9-16
Bluetooth Antenna NB UNII_L Extremity SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Point Scheme	Duty Cycle (%)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.																(W/kg)	(W/kg)	
2402	0	Bluetooth	FHSS	10.50	10.49	0.02	0 mm	Ant NB UNII_L (2.4GHz)	V1	KHYGHF6L25	1	N/A	7	76.9	1.002	1.008	0.102	0.103	
2402	0	Bluetooth	FHSS	10.50	10.49	-0.02	0 mm	Ant NB UNII_L (2.4GHz)	V1	KHYGHF6L25	1	N/A	10	76.9	1.002	1.008	0.123	0.124	
2402	0	Bluetooth	FHSS	10.50	10.00	-0.04	0 mm	Ant NB UNII_L (2.4GHz)	V2	YV4PVHN41T	1	N/A	10	76.9	1.122	1.008	0.090	0.102	
2402	0	Bluetooth	FHSS	10.50	10.49	-0.07	0 mm	Ant NB UNII_L (2.4GHz)	V1	KHYGHF6L25	1	N/A	11	76.9	1.002	1.008	0.109	0.110	
2402	0	Bluetooth	FHSS	10.50	10.49	0.00	0 mm	Ant NB UNII_L (2.4GHz)	V1	KHYGHF6L25	1	N/A	13	76.9	1.002	1.008	0.105	0.106	
2441	39	Bluetooth	FHSS	10.50	10.50	-0.03	0 mm	Ant NB UNII_L (2.4GHz)	V1	KHYGHF6L25	1	N/A	10	76.9	1.000	1.008	0.099	0.100	
2480	78	Bluetooth	FHSS	10.50	10.47	0.02	0 mm	Ant NB UNII_L (2.4GHz)	V1	KHYGHF6L25	1	N/A	10	76.9	1.007	1.008	0.085	0.086	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population													Extremity 4.0 W/Kg (mW/g) averaged over 10 grams						

Note: The reported SAR was scaled to the 77.5% transmission duty factor to determine compliance since the duty factor of the device is permanently limited to 77.5% per the manufacturer.

Table 9-17
NB UNII Antenna NB UNII_R Extremity SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Point Scheme	Duty Cycle (%)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.																(W/kg)	(W/kg)	
5201	Mid	NB UNII 1	FHSS	5.50	4.71	-0.05	0 mm	Ant NB UNII_R (5GHz)	V1	YWQ4M6TVH0	1	N/A	19	100	1.199	1.000	0.057	0.068	
5201	Mid	NB UNII 1	FHSS	5.50	4.71	-0.05	0 mm	Ant NB UNII_R (5GHz)	V1	YWQ4M6TVH0	1	N/A	22	100	1.199	1.000	0.069	0.083	A8
5201	Mid	NB UNII 1	FHSS	5.50	4.52	0.00	0 mm	Ant NB UNII_R (5GHz)	V2	YV4PVHN41T	1	N/A	22	100	1.253	1.000	0.054	0.068	
5201	Mid	NB UNII 1	FHSS	5.50	4.71	-0.17	0 mm	Ant NB UNII_R (5GHz)	V1	YWQ4M6TVH0	1	N/A	23	100	1.199	1.000	0.055	0.066	
5201	Mid	NB UNII 1	FHSS	5.50	4.71	-0.05	0 mm	Ant NB UNII_R (5GHz)	V1	YWQ4M6TVH0	1	N/A	25	100	1.199	1.000	0.064	0.077	
5731	Low	NB UNII 3	FHSS	5.50	4.62	-0.08	0 mm	Ant NB UNII_R (5GHz)	V1	YWQ4M6TVH0	1	N/A	22	100	1.225	1.000	0.042	0.051	
5731	Low	NB UNII 3	FHSS	5.50	4.62	-0.07	0 mm	Ant NB UNII_R (5GHz)	V1	YWQ4M6TVH0	1	N/A	25	100	1.225	1.000	0.053	0.065	
5731	Low	NB UNII 3	FHSS	5.50	4.75	-0.03	0 mm	Ant NB UNII_R (5GHz)	V2	YV4PVHN41T	1	N/A	25	100	1.189	1.000	0.059	0.070	
5731	Low	NB UNII 3	FHSS	5.50	4.62	0.02	0 mm	Ant NB UNII_R (5GHz)	V1	YWQ4M6TVH0	1	N/A	26	100	1.225	1.000	0.039	0.048	
5731	Low	NB UNII 3	FHSS	5.50	4.62	-0.06	0 mm	Ant NB UNII_R (5GHz)	V1	YWQ4M6TVH0	1	N/A	28	100	1.225	1.000	0.042	0.051	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Extremity 4.0 W/Kg (mW/g) averaged over 10 grams											

Table 9-18
NB UNII Antenna NB UNII_L Extremity SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Variant	Device Serial Number	Data Rate (Mbps)	Cover	Point Scheme	Duty Cycle (%)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.																(W/kg)	(W/kg)	
5201	Mid	NB UNII 1	FHSS	5.50	4.77	-0.08	0 mm	Ant NB UNII_L (5GHz)	V1	KHYGHF6L25	1	N/A	7	100	1.183	1.000	0.049	0.058	
5201	Mid	NB UNII 1	FHSS	5.50	4.77	-0.03	0 mm	Ant NB UNII_L (5GHz)	V1	KHYGHF6L25	1	N/A	10	100	1.183	1.000	0.052	0.062	
5201	Mid	NB UNII 1	FHSS	5.50	4.71	-0.07	0 mm	Ant NB UNII_L (5GHz)	V2	J9X0YHWQPH	1	N/A	10	100	1.199	1.000	0.045	0.054	
5201	Mid	NB UNII 1	FHSS	5.50	4.77	0.01	0 mm	Ant NB UNII_L (5GHz)	V1	KHYGHF6L25	1	N/A	11	100	1.183	1.000	0.043	0.051	
5201	Mid	NB UNII 1	FHSS	5.50	4.77	-0.09	0 mm	Ant NB UNII_L (5GHz)	V1	KHYGHF6L25	1	N/A	13	100	1.183	1.000	0.046	0.054	
5731	Low	NB UNII 3	FHSS	5.50	4.55	-0.07	0 mm	Ant NB UNII_L (5GHz)	V1	KHYGHF6L25	1	N/A	7	100	1.245	1.000	0.042	0.052	
5731	Low	NB UNII 3	FHSS	5.50	4.55	-0.09	0 mm	Ant NB UNII_L (5GHz)	V1	KHYGHF6L25	1	N/A	10	100	1.245	1.000	0.049	0.061	
5731	Low	NB UNII 3	FHSS	5.50	4.69	-0.05	0 mm	Ant NB UNII_L (5GHz)	V2	J9X0YHWQPH	1	N/A	10	100	1.205	1.000	0.049	0.059	
5731	Low	NB UNII 3	FHSS	5.50	4.55	-0.06	0 mm	Ant NB UNII_L (5GHz)	V1	KHYGHF6L25	1	N/A	11	100	1.245	1.000	0.039	0.049	
5731	Low	NB UNII 3	FHSS	5.50	4.55	-0.09	0 mm	Ant NB UNII_L (5GHz)	V1	KHYGHF6L25	1	N/A	13	100	1.245	1.000	0.039	0.049	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Extremity 4.0 W/Kg (mW/g) averaged over 10 grams											

9.3 SAR Test Notes

General Notes:

1. Batteries are fully charged at the beginning of the SAR measurements.
2. Liquid tissue depth was at least 15.0 cm for all frequencies.
3. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical, and thermal characteristics and are within operational tolerances expected for production units.
4. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
5. Per FCC KDB 865664 D01v01r04, variability SAR tests were performed when the measured SAR results for a frequency band were greater than or equal to 0.8 W/kg for 1g or 2.0 W/kg for 10g. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 11 for variability analysis.
6. The orange highlights throughout the report represents the highest scaled SAR per Equipment Class.
7. The phantom is filled with head tissue-equivalent medium.
8. For Head SAR evaluation, SAR testing was performed in a face-down phantom to evaluate all head use case conditions. SAR was evaluated with a separation distance of 0 mm between the device and the eye region of the facedown phantom to mimic expected use conditions.
9. For Extremity SAR evaluation, SAR testing was performed with a separation distance of 0 mm between the device and the flat phantom in several identified locations in the device for each antenna corresponding to the maximum averaged E-field spots based on simulation data.
10. The worst-case SAR configuration per band (e.g. 2400-2483.5 MHz, 5150-5250 MHz etc.) was spot-checked with the light seal which is a foam gasket covered in fabric connected to the head mounted device to ensure a good fit and seal out the ambient light. The smallest ("mini") and largest ("main") light seal available were used for the spot-check.

Bluetooth Notes:

1. The reported Bluetooth SAR was evaluated with a test mode with hopping disabled with DH5 operation. The reported SAR was scaled to the 77.5% transmission duty factor to determine compliance since the duty factor of the device is limited to 77.5% per the manufacturer. See Section 7.2 for the time domain plot and calculation for the duty factor of the device.

10 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

10.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v06 are applicable to devices with built-in unlicensed transmitters such as 802.11 and Bluetooth devices which may simultaneously transmit together.

10.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore, simultaneous transmission analysis is required. Per FCC KDB Publication 447498 D01v06 4.3.2 and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤1.6 W/kg. The different test positions in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1g or 10g SAR.

Note:
SAR Summations for some scenarios when the output power levels are reduced, SAR values at the maximum output power level were used as the most conservative evaluation for simultaneous transmission analysis.

*Per FCC approved test plan when two antennas operate in simultaneous mode, simultaneous transmission were treated independently for this configuration since their SAR peaks do not occur on the same plane and only one side of the device will become the main contributor to the overall SAR. See section 10.3 and 10.4 for more information about the Simultaneous Transmission Analysis.

10.3 Head SAR Simultaneous Transmission Analysis

Table 10-1
NB UNII Simultaneous Transmission Scenario with 2.4 GHz Bluetooth

Simult Tx	Configuration	NB UNII Ant NB UNII_R (5GHz) SAR (W/kg)	NB UNII Ant NB UNII_L (5GHz) SAR (W/kg)	Bluetooth Ant 1 SAR (W/kg)	Bluetooth Ant NB UNII_L (2.4GHz) SAR (W/kg)	Σ SAR (W/kg)	
		1	2	3	4	1+2+3	1+2+4
Head SAR	Head	0.033	0.036	0.047	0.005	0.047*	0.041*

Table 10-2
NB UNII Simultaneous Transmission Scenario with 2.4 GHz WLAN

Simult Tx	Configuration	NB UNII Ant NB UNII_R (5GHz) SAR (W/kg)	NB UNII Ant NB UNII_L (5GHz) SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)	
		1	2	3	4	1+2+3	1+2+4
Head SAR	Head	0.033	0.036	0.053	0.089	0.053*	0.089*

Table 10-3
NB UNII Simultaneous Transmission Scenario with 5 GHz WLAN

Simult Tx	Configuration	NB UNII Ant NB UNII_R (5GHz) SAR (W/kg)	NB UNII Ant NB UNII_L (5GHz) SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)	
		1	2	3	4	1+2+3	1+2+4
Head SAR	Head	0.033	0.036	0.099	0.059	0.099*	0.059*

Table 10-4
NB UNII Simultaneous Transmission Scenario with 2.4 GHz Bluetooth and 5 GHz WLAN

Simult Tx	Configuration	NB UNII Ant NB UNII_R (5GHz) SAR (W/kg)	NB UNII Ant NB UNII_L (5GHz) SAR (W/kg)	Bluetooth Ant 1 SAR (W/kg)	Bluetooth Ant NB UNII_L (2.4GHz) SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)			
		1	2	3	4	5	6	1+2+3+5	1+2+3+6	1+2+4+5	1+2+4+6
Head SAR	Head	0.033	0.036	0.047	0.005	0.099	0.059	0.146*	0.059*	0.099*	0.059*

Table 10-5
NB UNII Simultaneous Transmission Scenario with 2.4 GHz WLAN and 2.4 GHz Bluetooth

Simult Tx	Configuration	NB UNII Ant NB UNII_R (5GHz) SAR (W/kg)	NB UNII Ant NB UNII_L (5GHz) SAR (W/kg)	Bluetooth Ant NB UNII_L (2.4GHz) SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
		1	2	3	4	1+2+3+4
Head SAR	Head	0.033	0.036	0.005	0.053	0.053*

Table 10-6
2.4 GHz WLAN Simultaneous Transmission Scenario with 2.4 GHz Bluetooth

Simult Tx	Configuration	Bluetooth Ant 2 SAR (W/kg)	Bluetooth Ant NB UNII_L (2.4GHz) SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)	
		1	2	3	1+3	2+3
Head SAR	Head	0.063	0.005	0.053	0.063*	0.053*

Table 10-7
5 GHz WLAN Simultaneous Transmission Scenario with 2.4 GHz Bluetooth

Simult Tx	Configuration	Bluetooth Ant 1 SAR (W/kg)	Bluetooth Ant 2 SAR (W/kg)	Bluetooth Ant NB UNII_L (2.4GHz) SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)					
		1	2	3	4	5	1+4	1+5	2+4	2+5	3+4	3+5
Head SAR	Head	0.047	0.063	0.005	0.099	0.059	0.146	0.059*	0.099*	0.122	0.099*	0.059*

Table 10-8
2.4 GHz Bluetooth(TXBF) Simultaneous Transmission Scenario

Simult Tx	Configuration	Bluetooth Ant 1 SAR (W/kg)	Bluetooth Ant 2 SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Head SAR	Head	0.047	0.063	0.063*

Table 10-9
5 GHz WLAN Simultaneous Transmission Scenario with 2.4 GHz Bluetooth(TXBF)

Simult Tx	Configuration	Bluetooth Ant 1 SAR (W/kg)	Bluetooth Ant 2 SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)	
		1	2	3	4	1+2+3	1+2+4
Head SAR	Head	0.047	0.063	0.099	0.059	0.146*	0.122*

10.4 Extremity SAR Simultaneous Transmission Analysis

Table 10-10
NB UNII Simultaneous Transmission Scenario with 2.4 GHz Bluetooth

Simult Tx	Configuration	NB UNII Ant NB UNII_R (5GHz) SAR (W/kg)	NB UNII Ant NB UNII_L (5GHz) SAR (W/kg)	Bluetooth Ant 1 SAR (W/kg)	Bluetooth Ant NB UNII_L (2.4GHz) SAR (W/kg)	Σ SAR (W/kg)	
		1	2	3	4	1+2+3	1+2+4
Extremity SAR	Extremity	0.083	0.062	2.181	0.124	2.181*	0.186*

Table 10-11
NB UNII Simultaneous Transmission Scenario with 2.4 GHz WLAN

Simult Tx	Configuration	NB UNII Ant NB UNII_R (5GHz) SAR (W/kg)	NB UNII Ant NB UNII_L (5GHz) SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)	
		1	2	3	4	1+2+3	1+2+4
Extremity SAR	Extremity	0.083	0.062	2.855	2.658	2.855*	2.658*

Table 10-12
NB UNII TxBF Simultaneous Transmission Scenario with 5 GHz WLAN

Simult Tx	Configuration	NB UNII Ant NB UNII_R (5GHz) SAR (W/kg)	NB UNII Ant NB UNII_L (5GHz) SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)	
		1	2	3	4	1+2+3	1+2+4
Extremity SAR	Extremity	0.083	0.062	2.935	2.964	2.935*	2.964*

Table 10-13
NB UNII Simultaneous Transmission Scenario with 2.4 GHz Bluetooth, and 5 GHz WLAN

Simult Tx	Configuration	NB UNII Ant NB UNII_R (5GHz) SAR (W/kg)	NB UNII Ant NB UNII_L (5GHz) SAR (W/kg)	Bluetooth Ant 1 at 18 dBm SAR (W/kg)	Bluetooth Ant NB UNII_L (2.4GHz) SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)			
		1	2	3	4	5	6	1+2+3+5	1+2+3+6	1+2+4+5	1+2+4+6
Extremity SAR	Extremity	0.083	0.062	0.911	0.124	2.935	2.964	3.846*	2.964*	2.935*	2.964*

Table 10-14
NB UNII Simultaneous Transmission Scenario with 2.4 GHz WLAN and 2.4 GHz Bluetooth

Simult Tx	Configuration	NB UNII Ant NB UNII_R (5GHz) SAR (W/kg)	NB UNII Ant NB UNII_L (5GHz) SAR (W/kg)	Bluetooth Ant NB UNII_L (2.4GHz) SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
		1	2	3	4	1+2+3+4
Extremity SAR	Extremity	0.083	0.062	0.124	2.855	2.855*

Table 10-15
2.4 GHz WLAN Simultaneous Transmission Scenario with 2.4 GHz Bluetooth

Simult Tx	Configuration	Bluetooth Ant 2 SAR (W/kg)	Bluetooth Ant NB UNII_L (2.4GHz) SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)	
		1	2	3	1+3	2+3
Extremity SAR	Extremity	2.136	0.124	2.855	2.855*	2.855*

Table 10-16
5 GHz WLAN Simultaneous Transmission Scenario with 2.4 GHz Bluetooth

Simult Tx	Configuration	Bluetooth Ant 1 at 18 dBm SAR (W/kg)	Bluetooth Ant 2 at 18 dBm SAR (W/kg)	Bluetooth Ant NB UNII_L (2.4GHz) SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)					
		1	2	3	4	5	1+4	1+5	2+4	2+5	3+4	3+5
Extremity SAR	Extremity	0.911	0.839	0.124	2.935	2.964	3.846	2.964*	2.935*	3.803	2.935*	2.964*

Table 10-17
2.4 GHz Bluetooth(TXBF) Simultaneous Transmission Scenario

Simult Tx	Configuration	Bluetooth Ant 1 SAR (W/kg)	Bluetooth Ant 2 SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Extremity SAR	Extremity	2.181	2.136	2.181*

Table 10-18
5 GHz WLAN Simultaneous Transmission Scenario with 2.4 GHz Bluetooth(TXBF)

Simult Tx	Configuration	Bluetooth Ant 1 at 18 dBm SAR (W/kg)	Bluetooth Ant 2 at 18 dBm SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)	
		1	2	3	4	1+2+3	1+2+4
Extremity SAR	Extremity	0.911	0.839	2.935	2.964	3.846*	3.803*

Table 10-19
2.4 GHz WLAN MIMO Simultaneous Transmission Scenario

Simult Tx	Configuration	2.4 GHz WLAN Ant 1 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Extremity SAR	Extremity	2.855	2.658	2.855*

Table 10-20
5 GHz WLAN MIMO Simultaneous Transmission Scenario

Simult Tx	Configuration	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Extremity SAR	Extremity	2.935	2.964	2.964*

11 SAR MEASUREMENT VARIABILITY

11.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01r04, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results. SAR Measurement Variability was assessed using the following procedures for each frequency band:

1. When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
2. A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1g SAR limit).
3. A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4. Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg
5. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

Extremity VARIABILITY RESULTS

Band	FREQUENCY		Mode	Service	Ant	Data Rate (Mbps)	Side	Spacing	Measured SAR (10g)	1st Repeated SAR (10g)	Ratio	2nd Repeated SAR (1g)	Ratio	3rd Repeated SAR (1g)	Ratio
	MHz	Ch.							(W/kg)	(W/kg)		(W/kg)		(W/kg)	
2450	2417	2	802.11b, 22 MHz Bandwidth	DSSS	1	1	Extremity	0 mm	2.250	2.250	1.00	N/A	N/A	N/A	N/A
5250	5230	46	802.11n, 40 MHz Bandwidth	OFDM	2	13.5	Extremity	0 mm	2.660	2.570	1.04	N/A	N/A	N/A	N/A
5750	5755	151	802.11n, 40 MHz Bandwidth	OFDM	2	13.5	Extremity	0 mm	2.430	2.200	1.10	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Extremity 4 W/kg (mW/g) averaged over 10 gram						

11.2 Measurement Uncertainty

The measured SAR was <1.5 W/kg for 1g and <3.75 W/kg for 10g for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE 1528-2013 was not required.

SAR Summations for some scenarios when the output power levels are reduced, SAR values at the maximum output power level were used as the most conservative evaluation for simultaneous transmission analysis.

12 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E4404B	Spectrum Analyzer	N/A	N/A	N/A	MY45113242
Agilent	E4438C	ESG Vector Signal Generator	11/17/2022	Annual	11/17/2023	MY45093852
Agilent	E4438C	ESG Vector Signal Generator	11/17/2022	Annual	11/17/2023	MY45092078
Agilent	N5182A	MXG Vector Signal Generator	11/17/2022	Annual	11/17/2023	US46240505
Agilent	N5182A	MXG Vector Signal Generator	6/21/2022	Annual	6/21/2023	MY47420651
Agilent	8753ES	S-Parameter Vector Network Analyzer	6/14/2022	Annual	6/14/2023	US39170118
Agilent	8753ES	S-Parameter Vector Network Analyzer	1/12/2023	Annual	1/12/2024	MY40001472
Agilent	E5515C	Wireless Communications Test Set	5/4/2021	Biennial	5/4/2023	GB41450275
Agilent	E5515C	Wireless Communications Test Set	1/12/2023	Annual	1/12/2024	MY50262130
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB46170464
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343971
Anritsu	MN8110B	I/O Adaptor	CBT	N/A	CBT	6261747881
Anritsu	ML2496A	Power Meter	7/5/2023	Annual	7/5/2024	103084
Anritsu	ML2496A	Power Meter	9/1/2023	Annual	9/1/2024	105096
Anritsu	MA2411B	Pulse Power Sensor	5/19/2022	Annual	5/19/2023	1911105
Anritsu	MA2411B	Pulse Power Sensor	8/1/2022	Annual	8/1/2023	1027293
Anritsu	MA24106A	USB Power Sensor	2/9/2023	Annual	2/9/2024	2148505
Anritsu	MA24106A	USB Power Sensor	1/9/2022	Annual	1/9/2024	1349511
Control Company	4353	Long Stem Thermometer	1/26/2023	Annual	1/26/2024	160508097
Control Company	4353	Long Stem Thermometer	10/21/2022	Annual	10/21/2023	200645912
Control Company	4040	Therm./ Clock/ Humidity Monitor	1/17/2023	Annual	1/17/2024	160574418
Mitutoyo	500-196-30	CD-6"ASX 6Inch Digital Caliper	2/16/2022	Triennial	2/16/2025	A20238413
Keysight Technologies	N6705B	DC Power Analyzer	5/5/2021	Triennial	5/5/2024	MY53004059
Keysight Technologies	N9020A	MXA Signal Analyzer	4/14/2022	Annual	4/14/2023	MY48010233
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
Mini-Circuits	VLF-6000+	Low Pass Filter DC to 6000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	VLF-6000+	Low Pass Filter DC to 6000 MHz	7/5/2022	Annual	7/5/2023	31634
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mini-Circuits	ZUDC10-83-S+	Directional Coupler	CBT	N/A	CBT	2050
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Seekonk	TSF-100	Torque Wrench	7/11/2022	Annual	7/11/2023	47639-29
SPEAG	DAK-3.5	Dielectric Assessment Kit	10/17/2022	Annual	10/17/2023	1091
SPEAG	MAIA	Modulation and Audio Interference Analyzer	N/A	N/A	N/A	1237
SPEAG	MAIA	Modulation and Audio Interference Analyzer	N/A	N/A	N/A	1585
SPEAG	D2450V2	2450 MHz SAR Dipole	5/11/2022	Annual	5/11/2023	750
SPEAG	D2450V2	2450 MHz SAR Dipole	11/9/2021	Biennial	11/9/2023	921
SPEAG	D5GHzV2	5 GHz SAR Dipole	6/9/2021	Biennial	6/9/2023	1163
SPEAG	D5GHzV2	5 GHz SAR Dipole	11/17/2022	Annual	11/17/2023	1066
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/15/2022	Annual	9/15/2023	1684
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/15/2023	Annual	2/15/2024	1403
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/15/2023	Annual	2/15/2024	467
SPEAG	EX3DV4	SAR Probe	9/19/2022	Annual	9/19/2023	3949
SPEAG	EX3DV4	SAR Probe	2/13/2023	Annual	2/13/2024	7427
SPEAG	EX3DV4	SAR Probe	2/13/2023	Annual	2/13/2024	7308

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e., a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.

13 MEASUREMENT UNCERTAINTIES

Table 13-1
Face Down Phantom Uncertainty Table

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component (Specific Phantom)	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	Div.	c_i 1gm	c_i 10 gms	1gm u_i (± %)	10gms u_i (± %)	v_i
Measurement System									
Probe Calibration	E.2.1	7	N	1	1	1	7.0	7.0	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	0.7	0.7	0.9	0.9	∞
Boundary Effect	E.2.3	2	R	1.73	1	1	1.2	1.2	∞
Linearity	E.2.4	0.3	N	1	1	1	0.3	0.3	∞
System Detection Limits	E.2.4	0.25	R	1.73	1	1	0.1	0.1	∞
Modulation Response	E.2.5	4.8	R	1.73	1	1	2.8	2.8	∞
Readout Electronics	E.2.6	0.3	N	1	1	1	0.3	0.3	∞
Response Time	E.2.7	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1	1	1.5	1.5	∞
RF Ambient Conditions - Noise	E.6.1	3	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	3	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.8	R	1.73	1	1	0.5	0.5	∞
Probe Positioning w/ respect to Phantom	E.6.3	6.7	R	1.73	1	1	3.9	3.9	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	4	R	1.73	1	1	2.3	2.3	∞
Test Sample Related									
Test Sample Positioning	E.4.2	3.12	N	1	1	1	3.1	3.1	35
Device Holder Uncertainty	E.4.1	1.67	N	1	1	1	1.7	1.7	5
Output Power Variation - SAR drift measurement	E.2.9	5	R	1.73	1	1	2.9	2.9	∞
SAR Scaling	E.6.5	0	R	1.73	1	1	0.0	0.0	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	14.0	R	1.73	1.0	1.0	8.1	8.1	∞
Liquid Conductivity - measurement uncertainty	E.3.3	4.3	N	1	0.78	0.71	3.3	3.0	76
Liquid Permittivity - measurement uncertainty	E.3.3	4.2	N	1	0.23	0.26	1.0	1.1	75
Liquid Conductivity - Temperature Uncertainty	E.3.4	3.4	R	1.73	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Unceritainty	E.3.4	0.6	R	1.73	0.23	0.26	0.1	0.1	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)			RSS				14.0	13.8	191
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				27.9	27.6	

The above measurement uncertainties are according to IEEE Std. 1528-2013

Table 13-2
Twin Sam Phantom Uncertainty Table

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	Div.	c_i 1gm	c_i 10 gms	1gm u_i (± %)	10gms u_i (± %)	v_i
Measurement System									
Probe Calibration	E.2.1	9.3	N	1	1	1	9.3	9.3	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	0.7	0.7	0.9	0.9	∞
Boundary Effect	E.2.3	2	R	1.73	1	1	1.2	1.2	∞
Linearity	E.2.4	0.3	N	1	1	1	0.3	0.3	∞
System Detection Limits	E.2.4	0.25	R	1.73	1	1	0.1	0.1	∞
Modulation Response	E.2.5	4.8	R	1.73	1	1	2.8	2.8	∞
Readout Electronics	E.2.6	0.3	N	1	1	1	0.3	0.3	∞
Response Time	E.2.7	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1	1	1.5	1.5	∞
RF Ambient Conditions - Noise	E.6.1	3	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	3	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.8	R	1.73	1	1	0.5	0.5	∞
Probe Positioning w/ respect to Phantom	E.6.3	6.7	R	1.73	1	1	3.9	3.9	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	4	R	1.73	1	1	2.3	2.3	∞
Test Sample Related									
Test Sample Positioning	E.4.2	3.12	N	1	1	1	3.1	3.1	35
Device Holder Uncertainty	E.4.1	1.67	N	1	1	1	1.7	1.7	5
Output Power Variation - SAR drift measurement	E.2.9	5	R	1.73	1	1	2.9	2.9	∞
SAR Scaling	E.6.5	0	R	1.73	1	1	0.0	0.0	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	7.6	R	1.73	1.0	1.0	4.4	4.4	∞
Liquid Conductivity - measurement uncertainty	E.3.3	4.3	N	1	0.78	0.71	3.3	3.0	76
Liquid Permittivity - measurement uncertainty	E.3.3	4.2	N	1	0.23	0.26	1.0	1.1	75
Liquid Conductivity - Temperature Uncertainty	E.3.4	3.4	R	1.73	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Unceritainty	E.3.4	0.6	R	1.73	0.23	0.26	0.1	0.1	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)			RSS				13.8	13.6	191
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				27.6	27.1	

The above measurement uncertainties are according to IEEE Std. 1528-2013

14 CONCLUSION

14.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Innovation, Science, and Economic Development Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

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